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THE PROSPECT OF HUMAN PROGRESS[1]

MY principal purpose this evening is to invite you to look forward to the time to come and to enquire as to the prospect of human progress which is thus opened to view. But it will be necessary to give a great part of our attention to the past in order to build, as it were, a lookout from which we can obtain a vision of the future.

We shall not be so rash as to attempt a prediction of events or even of discoveries; but we shall try to determine the sort of progress which the indications of the present and the teachings of the past lead one naturally to expect. This will certainly be a safe procedure, provided that we can find common elements of fundamental importance in the basic characteristics of each period; for it can hardly be supposed that the future will suddenly depart from the principles of progress which have been impressed upon the race throughout its long period of evolution up to the present.

It will be necessary for us to pass in rapid review the great stages of development by which man has changed from a beast-like savage to a cultured civilian. We shall find that these stages have been marked off by a few leading inventions, each of them giving a fundamental new element to the period of progress following its appearance. In this review we shall be guided primarily by the researches and conclusions of ethnologists.

It is probably impossible to conceive of man existing as man and not having the elements at least of language for intercourse with his fellows. Therefore, by com-

[1] An address delivered to the Graduate Club of Indiana University on the evening of May 7, 1914.

mon consent, it has been supposed that primitive man was in the possession of spoken language, developed to such a degree as to enable him to communicate effectively with his associates.

A moment's reflection will be sufficient to bring to mind the immense importance of language to any animal fortunate enough to have found, by chance or otherwise, a means for its development. He has for the first time, in the words of his language, a sort of concrete receptacle for his thoughts. Prior to the acquisition of this tool for thinking, his thought had been, as it were, a fluid stream from which he could take up and hold permanently only that which would adhere to a sieve dipped into the stream. He could not give his thought objective existence as standing out before him. He could only feel its passage as it was driven through his mind by one impulse after another from his material environment. But with language at his disposal the case becomes different. Between the language and his thought there is a mutual reaction; and by means of the former the latter is deposited so that it may become the subject of objective study. The immense impetus which this would give to the development of the intellect must be apparent to every one.

There is another and greater element of development in the invention of language, namely, that which is associated with the power of intelligent intercourse. By its means our primitive man has become able to live in part outside of himself and in the thought of others. Thus he can project into himself the experiences of many other persons. This gives a new richness and a new meaning to his life. He is no longer confined to the range of his own experience as his means of development. All his contemporaries, so far as he knows them, can be made to contribute to his progress and be themselves gainers in the act. And even more than this is true: the experience of one generation can be passed down by tradition to the next. Thus the cumulative effect of the progress of one generation after another first became available to our primitive ancestors. It gave a great impetus to progress.

Indeed, it is true, I believe, that man has not yet taken another step of advancement of as great importance to him as this first one; and consequently I have dwelt on it at some length. It is also to be contrasted, as you will see, with the greater part of his later progress. For, it is essentially intellectual in its character, whereas much of the other depends for its value on the increased control which it gives man over his material environment.

The next stage of development was brought in, it is supposed, by the discovery of the uses of fire. The knowledge of fire is so widely distributed that it is a question whether any authentic instance is on record of a tribe altogether ignorant of it. By means of its use man became able to leave the tropical parts of the world and to go into the more invigorating temperate climates. He also had an enlarged and more nutritious food supply, owing to the increased value of many meats and vegetables on being cooked.

The next prime invention appears to have been that of the bow and arrow. Its chief contribution to progress is also in the increased and improved food supply which it made available. A tribe using the bow and arrow could have meats at all times. Such a diet probably contributed to increase the physical vigor and the courage of the savage possessed of it for the first time. The primitive tribes of Australia and Polynesia had not advanced to this stage when they were discovered a few generations ago.

It appears to be the general opinion that each of the three stages brought in by the three discoveries and inventions named endured for a long period of time, perhaps for something like one hundred thousand years or longer. In all of these stages our ancestors were yet in the savage state. The advance to the higher state of barbarism was brought about by the marvelous discovery of a means of making pottery. Man learned to fashion moist clay into a useful shape and burn it into hardness so that it would endure use. The vessels so constructed afforded him a means of boiling his meats and vegetables so that many of them became highly palatable, whereas they were almost or quite inedible when merely roasted before a fire.

Man, having advanced thus far, was still in a very unsatisfactory state when viewed from our present organization of communities with fixed abodes. He was necessarily nomadic. If he settled down to live permanently at a given place, then the animals, upon which he depended so largely for food would soon disappear from that vicinity both because he destroyed them and because he excited fear in them. But after a time he found means for overcoming this difficulty. Doubtless it had proved profitable, to both the men and the dogs, for the two to hunt together. Thus the dog came to be domesticated. When the idea that captive animals could be of service was clearly conceived, it was an easy step to the domestication of the sheep, the ox, the camel, the horse. Thus man came to have a meat and milk supply readily procurable at all seasons; in addition, he had in the horse and the dog valuable assistants in the chase. As his animals required pasture he came naturally to recognize the value of an increased yield from the soil. Thus, from being a herdsman, he gradually developed into a husbandman. Then he came to have fixed abodes, and the idea of nationality began to take definite shape.

At this stage of development man had no very effective tools. Wood and bone and chipped flints were the materials out of which were made such as he had. Presently some one made the master discovery of the art of smelting iron. From this time forward man was equipped with tools worthy his hand and his brain.

This invention brought in the last of the three periods of barbarism. Each probably extended over many thousands of years. During these periods man had leisure for the development of his artistic sense; and the way in which he used this leisure is indicated by the remains of his art which have endured to the present day—such as the wonderful paintings found in numerous caves in Europe.

The age of civilization, properly so called, was now brought in by an invention comparable to that in connection with which man emerged as man from his previous savage state. That early advancement, you will recall, was associated with the development of spoken language. The new age of civilization was brought in by the acquisition of written language.

From this time forward progress has been much more rapid than previously. The first stage of civilization extended over the period from the invention of writing to the close of the so-called middle ages, when a new stage was brought in by the invention almost simultaneously of gunpowder, the mariner's compass, paper and the printing press. Coupled with this was the scientific discovery and the demonstration by Copernicus that the sun and not the earth is the center of our planetary system.

These inventions and discoveries brought about simultaneously three fundamental revolutions in human thought and human

relations. By means of gunpowder the peasant became a match for the bravest knight, so that the latter could no longer trample over the former in safety. The castle of the lord no more could serve as a certain stronghold against danger. Gunpowder became a mighty leveling influence and began to prepare the way for equal rights to all men. Through the use of paper and the printing press books were soon widely distributed among a large class of people whereas before they had been the luxury of a few rich nobles. The advances in astronomy turned men's minds upside down, as it were, and set them to feeling that all conceptions of the world and of man were in need of fresh examination and possibly fundamental revision. Add to this the power of the mariner's compass, which enabled men to sail in safety across unknown seas, so that the whole wide world was about to come under their dominion. You can not fail to see that all these things, thrown as they were at once into experience, would undoubtedly produce a profound stir and commotion in the human mind. Such was the state of experience and such were the means of development in the middle stage of the higher civilization.

A period characterized by so much activity would naturally be one of rapid change. You would therefore expect it not to last long. Such indeed was the case. Only about four hundred years had elapsed when, towards the close of the eighteenth century, James Watt gave to the world the perfected steam engine. A new tool of power was thus in the hands of the men of that and future generations. It increased the working speed manyfold and thus brought in a period characterized by greater leisure for the cultivation of those elements of civilization not directly connected with obtaining a food supply. Man then entered upon the present stage of civilization, the highest to which he has yet attained.

We have now passed in rapid review the elements of the material basis for the progress of mankind. We have necessarily considered only the greatest outstanding facts. Now I should like to ask each of you to take these facts and to build them into a lookout from which to view for a few minutes the prospect of human progress. Or, if you prefer a different figure, will you consider these as constituting a mirror in time by means of which you can see in the past and the present the image of the future, just as by means of a mirror in space you see an extended image in one position while its object is in another?

In the first place, let us ask in what way these inventions and discoveries may be looked upon as the cause of progress. A cause may operate in two very different ways. If a ball is fired from a rifle the explosion of the powder *impels* it into motion and drives it forth. There are other causes in operation; but this is the fundamental impelling one. On the other hand, if the same ball is held at some height and the support is removed, it will also be set in motion. Undoubtedly the taking away of the support is one of the causes of this motion. It is not, however, the impelling cause; it is one acting by release.

If, now, we consider the means of progress we have mentioned, we can find no power in them through which they could have been the impelling causes of human progress. They undoubtedly operated by way of releasing the activity of man. We must assume, then, that there was a power of development inherent in human nature and that these inventions and discoveries merely released that power into activity. That appears to be the teaching of the whole of human progress. It is illustrated

also in the development of the individual. It is clear that the environment is not creating the growing intellect; but it is serving as a means of release to set free its activity and is thus making possible its attainment of power. The fire which lighted the savage's camp in the woods also kindled the intellect of the man who operated with it. It gave him new things to consider. Ultimately it put new tools into his hands and finally it has led his descendants into their most remarkable inventions.

These considerations make it clear that we shall have a fundamental understanding of progress only when we take into account the intellectual and moral and spiritual forces which are released or developed from age to age. These things are elusive; it is hard to get a grasp of them. They have in them the fluidity of life and they slip through our fingers so that we can hardly hold them. And yet they have doubtless had a profound influence of their kind, especially upon the relation of man to man. Consider, for example, this one command, "Thou shalt love thy neighbor as thyself." T. H. Green remarks that this has not varied in form during the whole of human development but that there has been a profound change in the answer to the question, Who is my neighbor? As our conception of duty and one's responsibility to his fellow has widened, we have given a broader and broader answer to this question, so that now every member of the human race is to be considered as our neighbor. Indeed, we have gone further than that and have come to include within the pale of our brothers even the most remote tribes of men. Obviously, this conception, moral or religious in character, must exercise a profound influence on the civilization of the future. Likewise other matters of this sort must have their important places; and we will give a just reflection of progress only when we take them into account.

In this connection I must call your attention more precisely to the interplay of material and intellectual forces. We have spoken of the former as releasing the latter. To stop here would be to give a very partial view of the situation. As soon as the intellect has come into play material things will be put into juxtaposition which are not found so in a state of nature. Thus the mind is able to release material forces which had not been in evidence before. These in their turn stimulate the intellect to a greater activity and thus increase its powers. Then we have new juxtapositions of natural things brought about through the deeper insight of the mind into the relations of phenomena. The connections which are thus put in evidence become more and more profound until at length we find man able to control the elusive electricity and by its means to transmit great powers of nature into his homes and his shops, subdued and taught to do his labor for him at his bidding. There seems to be no limit to the progress which may be engendered by this interaction between material and intellectual forces.

Of a similar character, but still more profound in its effect, is the quickening due to the intercourse of man with man. It was this, as we have seen, which characterized the first period of human development. One can not doubt that it has played a fundamental rôle throughout the whole range of progress.

It has been observed many times that a new vigor of character is produced by the intermingling of different races or nationalities of peoples at corresponding stages of development. The new is stronger than either of the elements which go into it.

There is a mutual stimulation which carries them into greater power than either could have attained alone. It is like the production of certain alloys where the mixed metal is much more useful than either of its constituents. The combination possesses properties which do not seem to be in either of the elements combined. It is this intermingling which gives to the character of colonial peoples that remarkable virility which it is often observed to possess. It is this which throws back from the colonies such an influx of power into the mother country. We shall get a picture of how all this is so if we consider the human race to have had at first certain potentialities of development and each group to have lost or to have weakened certain of these while developing others to a considerable or to a vast extent. What we get, then, by the intermingling of these different peoples is the reuniting of these various potentialities, in their developed and strengthened form, so that we come to have in a single individual a combination of elements of power which could be brought to him only by the junction of divergent streams of progress.

Looking at the matter thus we see strong grounds for optimism as to the prospect of further development. Never before in the history of the world has there been so much amalgamation of peoples as at the present time; and consequently there has never before been such an opportunity for reuniting the potentialities which have developed along divergent lines. There is greater facility of travel; means of communication have increased to a remarkable extent; and nations and peoples begin to exhibit a spirit of cosmopolitanism, so that the feeling of world citizenship is coming to play an effective part in the affairs of commerce and government. There is growing up also a demand for a universal language to facilitate intercourse; but what this will result in one can not at present predict with confidence.

World-wide intermingling of peoples carries with it, no doubt, its characteristic attendant dangers. The various local civilizations which were developed in earlier times, such, for instance, as those of Greece and Rome, ceased to flourish when their central populations became stagnant through the lack of accretions from without. It appears that one line of development can not continue indefinitely unless the potentialities which the people lose in their progress are supplied to them again by another people who have retained what the former had lost. Therefore, if the whole world should become a single community with a single life, we should have only one line of development in progress and hence should naturally suffer in the end a resulting stagnation.

This, however, is probably a danger which should not be anticipated. Though the whole world may be brought very close together by the present tendencies of civilization, it can hardly be supposed that it would grow into a single people with a single life. Such a thing has hardly yet taken place in England after a thousand years of close association on the part of peoples which were descended from a common stock not far removed. Furthermore, if any one should feel that there is ultimate cause for alarm in this matter, the problem could yet be safely left to the future for solution. We may be confident that it will be dealt with in a wise manner when it arises. So many new influences are now coming into play and so many lines of progress are converging into a great central stream that it would be hazardous to undertake a suggestion as to how this problem could be dealt with. It is a question for the future and the future must answer it.

Will you allow me, now, to turn abruptly

to an examination of these chief elements of progress from a different point of view, one which more precisely characterizes the outlook of the man of science? It is this latter point of view, I believe, which is most suggestive of the prospect of progress lying out before us.

If we look at those general elements which have characterized the principal stages of development—those, namely, of savagery, barbarism and civilization proper—we shall find that they are marked off by certain leading conquests, as follows:

During the period of savagery man was winning his way to a partial conquest of the world in the large. At its beginning he was confined to a relatively small portion of the earth's surface, namely, to the more tropical parts. This was true for two reasons: he had not yet discovered means to protect himself against the more rigorous climates; he also required to remain in a region where a food supply was available throughout the year. During the period, however, he acquired the control of fire and invented the bow and arrow. He thus became able to take care of himself throughout a much wider portion of the earth's surface, thanks to his increased control over material things.

In the next period, that of barbarism, he began to bring under his control the animal, vegetable and mineral kingdoms. The animals were taught to do his work and were kept also for a food supply. He learned to cook vegetables so as to render them much more palatable. Furthermore, he acquired the use of iron. In all this, you will observe, he was still dealing with things in the large.

During the next period, that of civilization proper, there was the first adumbration of a control of things in the small; but it was only an adumbration. It is the energy of molecules which gives to the steam engine its power; but this engine deals with them in the mass and not in the small. So has it been in the control of electricity attained during previous generations; men have not dealt with it in the small.

Thus, throughout all progress until the time of the last generation, it has been true that the conquests of men have been over things in the large.

There is strong reason to believe that we are now entering upon a new stage of progress brought on by the mastery of things in the small. I shall indicate briefly some of those over which we are now gaining such control.

We are no longer content to study electricity in the large; we have chased it down to the electron and probably even to the sub-electron. We are thus in a position to get a fresh insight into its phenomena. We have studied the various rays, visible and invisible, which are produced by the discharge of electric particles; and by means of them we have learned to photograph the bony framework and even the soft organs of the living human body. Here we have begun a conquest which we hope to carry on to many fundamental results.

Ordinary matter also is yielding up to us a more profound secret than we have ever before brought to light. This began with the study of emanations from radium and has been continued with a number of other substances. Furthermore, we have been able to strike off from atoms of various kinds the electron itself and have thus disclosed the intimate kinship of elements which previously had been considered entirely distinct. Here again we have just begun a conquest which we hope to carry on to many fundamental results.

Our men of science have also entered into the living organism and have begun to

study the basis of life itself. Witness the frequent investigation of living cells and even the elements, such as chromosomes, of which these are composed. Here the researches of Mendel and his followers come into play, revealing to us a new means through which we may hope ultimately to control even the character of those yet unborn. Here also we have just begun a conquest which we hope to carry on to many fundamental results.

There is one other mastery over things in the small to which I wish to call your attention, one having in it a great power for the development of strong and vigorous human beings, ready for the further advances of the future. I refer to our new and increasing knowledge of disease-producing germs. Here also we have just begun a conquest which we hope to carry on to many fundamental results.

Thus there has been opened to us in a short space of time a varied and undreamed-of world in the small over which we are now to gain the mastery. Our analysis of previous progress shows that we have here something vitally new. It should therefore lead to important development. Our confidence in this is great, since a little reflection on the matter brings out the fact that we now have converging into one main stream many of the elements which have characterized previous progress.

The actual development which we thus anticipate will be realized only if science indeed makes the conquests which seem to lie out before us. Why, then, may we feel sure of such advance? Time will allow only a brief answer. A slight examination of the past will put in evidence the fact that the fundamental discoveries of the earlier ages came about mostly by chance. Men were not seeking systematically to know the secrets of nature. They learned a few things in a haphazard way. They had not found out how to make a systematic and all-embracing search through fields either old or new. Fresh discoveries continue to be made right up to the present and with greater speed than ever before. New sorts of questions are asking for an answer. This indicates that the undiscovered regions yet to be found are vast in extent. To-day an increased number of persons are seeking the new. They have learned better methods of research and are able to go about their problem in a more systematic way. Undoubtedly there is still in human character the potentiality of great power to be released through the excitation of new discoveries. Therefore one can not fail to have the best of confidence that there is a long and important line of advancement now to be followed out.

Thus we have at hand every means of progress. The prospect is a pleasing one. He who works at this builds something into all subsequent human development. This is a labor worthy the mettle of the noblest intellect. The science of to-day is lighting the way of progress; and every real contribution to its results will make brighter the illumination of the future. I congratulate you that you have entered upon this labor. May the flower of science blossom at your touch and the vine of knowledge bear luscious fruit under your hand and the pure wine of its vintage flow forth to swell the stream of progress.

R. D. Carmichael

Definiteness of Appointment and Tenure[1]

The college professor is rapidly being forced to occupy a new and important position in our public affairs and is receiving more of the

[1] Delivered before the College Section of the Association of American Agricultural Colleges and Experiment Stations, Washington, D. C., November 13, 1913.

recognition which his profession has long enjoyed in the older countries of Europe. A university professor who rose from the ranks occupies the White House; another is a prominent member of his cabinet; and large numbers of college and university professors are prominent in the direction of municipal, state and national affairs. This new appreciation of the teacher and the failure of some governing boards to understand their relation to him have led to a considerable discussion of his academic position from various points of view. Much of this discussion has centered around the matter of his tenure of office. Tenure is, of course, affected by the definiteness of the appointment, including its phraseology, and may be affected, though not necessarily so, by the method of appointment, which may vary widely without prejudice to the incumbent's tenure. Furthermore the method of retirement for old age by retiring allowances or pensions may have an important bearing, but need not be discussed after the very full presentation of this matter by Dean Davenport.

Although there has been considerable discussion of specific cases in which the matter of tenure has been involved, broad statements dealing with present customs and determining principles are few in number. The only satisfactory discussion I have found is that of President Van Hise[2] before the Twelfth Annual Conference of the Association of American Universities at the University of Virginia in 1910. In this address President Van Hise fully described the practise of the universities which are members of that association, and so clearly stated the principles which should govern that there seemed to be a general concurrence in his views. That association, however, includes only 22 of the leading American universities offering graduate work, 9 of which are not state-supported institutions, and only 7 are members of this body. It was evident, therefore, in order adequately to discuss this problem as it pertains to the land grant colleges, that facts must be secured concerning our present customs and the views of our members. Hence a questionnaire was sent to the presidents and deans of agriculture of all the land grant colleges. The replies received from forty-three institutions seem to justify the following statements.

Only eight institutions use definite forms for notices of appointment. Appointees are notified by the president in nineteen states, in ten by the secretary of the governing board, in two by both the president and secretary, and in one by the university treasurer. A formal acceptance is required at three institutions, sometimes only of instructors, and two use a written contract signed by the president and appointee. The time or conditions of tenure are specified in the appointment in nineteen institutions, and are not thus specified in ten. Duties are specified in the appointment in five institutions and merely by the title of the position in sixteen. In several colleges duties are thus stated if special reasons make it necessary.

The replies to the queries concerning the manner of appointment are neither conclusive nor illuminating, except in showing that there is no general usage and that it seems to be usually considered of but little importance. This is evidenced by the fact that in several institutions the appointee may be informed simply by word of mouth. Furthermore, some of the replies are evidently inaccurate, for some institutions state that they specify the time or conditions of tenure in their appointments which, as a matter of fact, do not do so. It is interesting to note that the few institutions which use formal appointments and are most definite in the form thereof are among those generally recognized as best administered and those which are most lax in this matter are among the smaller institutions. The most usual procedure is for the president to write the appointee that he has been elected to a certain position, naming the title and salary, and the date effective. It is usually stated

[2] Van Hise, C. R., "The Appointment and Tenure of University Professors," Journal of Proceedings and Addresses of the Twelfth Annual Conference of the Association of American Universities, pp. 50–61; also in SCIENCE, Vol. XXXIII., p. 237.

that the time of tenure and the duties involved are "understood" by both parties. The writer is convinced, however, that in most cases a definite statement of these matters is desirable in the appointment. A university president recently remarked that some one had said that all college presidents are liars. Obviously this exaggeration is due to the fact that no president, dean or director can remember all the "understandings" necessary to manage the affairs in his charge. The more business that can be done in writing the better, as is shown by the general practise of large business concerns. Doubtless railroad presidents would find it difficult to operate their roads and might also become eligible to the "Ananias Club" if they depended on "understandings" instead of written letters. In many cases this lack of definiteness in appointment is due to the fact that the institution has no generally established and generally understood policy concerning these matters, a situation which makes a system of definite appointment all the more necessary.

Furthermore, the appointment should state the principle and essential duties of the appointee. Usually the title of a full professorial position will be sufficiently indicative. If, however, an appointee is to be engaged in the college, station and extension work, or in more than one line, the appointment should clearly state the facts. Is it fair to appoint a man to an indefinite position and then expect him to do whatever sort of work he may be assigned, for some of which he may be poorly fitted, though otherwise well qualified? Should he be asked to change his line of work unless a new, definite and acceptable appointment is submitted to him? The by-laws of one institution states that "any teacher can be called upon for other duties without additional pay." Instances are not uncommon where dissatisfaction has arisen owing to assignment to work of a kind not contemplated by the appointment or previously "agreed upon." The replies to the questionnaire as to the appointment of professors for an indefinite or specific term were as follows. Twenty-two institutions appoint for an indefinite term; seven use a probationary period of one year and two or three years, followed by indefinite tenure; eight appoint annually, but claim the custom of reappointing during efficient service—a policy often expressed by formal resolution of the governing board so as to be equivalent to indefinite tenure; two appoint strictly annually, and one uses "either" method. In a few institutions professorial appointments are "permanent." If this phrase—permanent tenure—implies tenure for life or until old age retirement, it is much better than the term "indefinite," which really means nothing. Associate professors are usually given the same tenure as full professors, except in three institutions wherein appointments are made for definite terms of from one to five years. The institutions appointing annually, with a probationary term, and for indefinite tenure, do not form any natural grouping or classification. Only two of the ten making annual appointments are among our larger institutions and in these appointees undoubtedly enjoy indefinite tenure, though technically appointed annually. The nine institutions wherein probationary appointments obtain are widely scattered and are relatively small colleges. In practically all of the larger institutions professors enjoy indefinite or permanent tenure upon the first appointment.

In reply to the question whether all faculty members were appointed annually and whether such a system was opposed or favored, from the ten institutions wherein the system of annual appointments is in vogue only two writers favored the system, while three opposed it and five were silent. Thus there is practically unanimous opposition to annual appointments and commendation for the system of indefinite or permanent tenure, at least after a probationary period. The questionnaire elicited opinions to the effect that annual elections cause restlessness; deter strong men from accepting places subject to annual election; discourage loyalty to the institution; are commonly perfunctory; and create an uncertainty incidental to changes in the personnel of the governing board. One replies

that inasmuch as college salaries are relatively low owing to the assumed permanency of tenure, that it must therefore be guaranteed as a matter of justice. Another cites fifteen years of unsatisfactory experience with annual elections. Only two correspondents favor annual elections, one of whom says, "it works no disadvantage" and the other writes,

> I favor the system except as to the higher administrative officers for purposes of discipline and good service. I think the administrative officers should be allowed to feel secure in order that definite plans and purposes can be worked out.

There seems, however, to be nearly unanimous opposition to these views.

Several institutions observe annual elections, but practically guarantee indefinite tenure. Thus in Ohio the state constitution prevents any legislature from appropriating beyond its life and the university trustees hold that they can not legally contract beyond their appropriations. Hence appointments are made every year. However, the trustees have also passed a resolution stating that it is

> their desire that teachers should remain securely in their tenure of office and that the legal annual election was not to be interpreted as any uncertainty of mind on the part of the board of trustees.

Appointments are annual at Cornell University, but

> it is the established policy of the university that a man once installed continues indefinitely.

The notice of appointment also states that the salary is contingent upon the appropriations. It will hardly be questioned that at these two institutions professors enjoy permanent tenure, though technically elected annually. However, in some other institutions claiming to employ the same system, the situation is not as clear. One president writes:

> All the other members of the staff are technically reappointed for the year when the budget for the coming year is made out. Any one not reappointed at this time (June) is continued on the payroll until the first of September, giving him three months' notice. Usually when the employment of any one is to be discontinued we notify him sometime before June that if the budget is approved we will not recommend his reappointment.

One can not help but feel that where institutional traditions are not firmly established or where frequent changes may occur in the governing board, a system of annual elections must tend to militate against permanency of tenure and to make removal easier. Even the necessary annual budget may sometimes have a similar effect if the governing board does not clearly understand that its adoption involves merely a statement and not a reappointment. The inconsistency of the policy of some institutions was clearly indicated by one president who stated that his professors enjoyed indefinite tenure, but who held that to terminate a professor's service "he should not be reappointed and the reason should be given him." Boards have been known to secure removals by the simple process of dropping names from the budget.

It is difficult to see just what advantage accrues from or what necessity exists for annual elections. Were the position of the Ohio trustees tenable, most state institutions would be forced to elect annually, for both state and federal appropriations may legally be withdrawn at any time. Is not, however, a professorial position analogous to one held under the U. S. civil service? A civil service appointee enjoys an indefinite tenure during good behavior and is protected against removal except for good cause; but at any time Congress may fail to appropriate funds for a given salary or may abolish a position. Have not the trustees of state institutions the right to make permanent appointments, qualifying them with a statement that in so far as salaries are derived from appropriations they are dependent upon them? Would not such a system conduce to greater permanency of tenure?

Professorial appointments for trial terms of from one to three years followed by indefinite appointment is a different matter and may often be a desirable system. It is evident that our larger institutions can command the services of our best men and can so determine the worth of a prospective candidate as to

leave no doubt of his qualifications for permanent appointment. But at smaller institutions the full professor is often of the same grade as is the assistant or associate professor in the larger ones. It is not always possible to determine his worth or the wisdom of a permanent appointment until his ability is tested. Often young men are chosen who are expected to grow with the development of their departments. A trial alone will show whether they will or will not measure up to the expectations. Hence, a definite appointment for a probationary period, with the possibility of a subsequent permanent appointment is fair both to institution and appointee.

Information was sought by the questionnaire as to the tenure of assistant professors and instructors. Six institutions having indefinite tenure for professors appoint assistant professors for from one to five years and ten appoint instructors for a term of from one to three years. Only eleven institutions have indefinite tenure for all the faculty.

To the question whether short-term appointments for assistant professors and instructors were favored, twenty-two affirmative and fourteen negative replies were received. Most of our larger institutions have found such a procedure advantageous. Some of the comments on this matter are of interest. Dean Davenport, of Illinois, states that instructors being young men should move about from one institution to another, in order to gain experience and to work for advanced degrees; but that assistant professors only occasionally should be short term men, more particularly when they are first given responsibilities involving a good deal of trial. He remarks that sometimes when men are made assistant professors that they stop growing. President Hill, of Missouri, replies:

> It seems to me that the appointment for short terms is desirable until the efficiency and prospects for growth of an instructor or assistant professor are pretty clearly indicated. I take it, however, that there will always be some assistant professors in an institution who have already demonstrated their efficiency, but whom the administration is not yet ready to recognize as permanent members of the teaching force, preferring to see them first make good some of their promises in teaching and research.

These opinions seem fairly to voice the views of the majority, some of whom point out that short appointments of instructors encourage them to do graduate work.

It would seem that although a few institutions elect their professors annually, nearly all consider the term of the full professor as indefinite or permanent, at least after a probationary term. This being the case, the question of terminating the tenure of a professor arises. Three causes, viz., old age, gross misconduct or general inefficiency, may warrant his retirement. The matter of age retirement and the principles upon which it should be based depend largely upon the resources of the particular institution and need not be further discussed in view of Dean Davenport's masterly review of the subject immediately preceding the presentation of this paper. There would probably be no question as to the propriety of the removal of a faculty member for gross misconduct of such a nature as to make him an undesirable associate or teacher. Cases have occasionally arisen, however, where it has been claimed that men have been removed on account of their economic, philosophic or religious views, as expressed in their teachings. Probably injustice is sometimes done in this regard, but doubtless the aggrieved party has usually been removed more on account of his lack of a proper sense of propriety than because of his expressed doctrines. Undoubtedly we would all agree that absolute "academic freedom" must exist as far as the teaching of truth is concerned.

The really difficult cases are those in which the incumbent is generally inefficient or a misfit, in which it is unnecessary and undesirable to make detailed and definite charges, but in which there is no question that for the welfare of both the institution and the incumbent a severance of official relations is desirable.

With this situation in mind the questionnaire sought information by asking:

If a professor is appointed with an indefinite tenure of office, what should be the method of terminating his position if his services are unsatisfactory, provided there are no specific charges against him?

Nearly all who replied to this question indicated that the president should hold a frank conference with the man and urge him to relocate, and should give him ample time wherein to secure a new position. Replying to the query as to what constitutes such ample time, three favored two months, five three months, two four months, fourteen six months and five a year. Two of our most experienced executives stated that they had found a year too long a period, as it interfered with the work of their institution. Dean Davenport has answered these questions so well that I again quote from his letter:

This is an exceedingly delicate question. It refers, of course, to that kind of lack of success which it is difficult to define and certainly against which specific charges can not be made. Personally I believe if the case is not flagrant and the institution is large enough and strong enough to do it, it is best to supersede the position in some quiet way and by reorganization to push the work ahead without the man. But if the issue must be met squarely, then I believe in doing it by the frankest method possible; namely, by discussing the matter with him and showing him why it is that the university must have a change. I think that in the case of a man's becoming undesirable in a responsible position, the very fact that he has been given this responsible position entitles him to great consideration. It seems to me that the best plan is for the institution and the man alike to understand the situation and both to do what they can to find another position where the man can presumably succeed. I do not mean by this that an incompetent professor should be peddled off on another institution; only this, that if the institution ever gave him a professorship, it must have been for a very good reason and his failure is most likely to be due to changing conditions. Under such considerations it is not difficult to find other places where the conditions are more favorable for good work. Except in rare cases, therefore, I would not make the notice definite, but rather indefinite.

Occasionally a case arises in which such treatment must be followed by definite action. Sometimes a man refuses to make a reasonable effort to secure another position, even after he has been given ample time to do so. Under such circumstances we doubtless would all agree that it would become necessary to formally request his resignation.

In reply to the query whether under such circumstances the notice should be made a matter of record where it may become public, only four answered "yes," and all other replies were "no." There seems no good reason why such a matter should be recorded as public property unless the man himself makes such action necessary. This simply means that in most institutions such notice should be given by letter from the president and not by action of the governing board, which usually becomes public.

The final question asked whether there is any justification for a new managing board declaring all positions vacant and reappointing whomsoever they see fit. Only two replies indicated that possibly circumstances might arise warranting such action. The other forty replies are so emphatic in their condemnation of such a proceeding that the query might seem useless. However, according to published reports there have been one or two recent cases of such drastic action. Formerly such "turnovers" were much more common. Some of these replies may well be quoted if for no other purpose than to voice the universal sentiment of all college men. One writes:

It is a cowardly way to treat the situation.

President Snyder of Michigan writes:

A new managing board that declares all positions vacant is simply advertising to the world its own inefficiency and lack of appreciation of the great responsibility which has been placed upon it.

President Aley of Maine writes:

I know of no justification whatever for a new board to declare all positions vacant. It seems to me that such a proceeding will result in chaos in an institution. Certainly no self-respecting man would want a position in a college where such a thing is likely to occur.

President A. R. Hill of Missouri expresses himself as follows:

I can see no justification for a new managing board declaring all positions vacant and reappointing whomsoever they see fit. The appointment by any managing board I regard as a mere formality. The real appointment should always be made by the faculty of the department concerned, including, of course, the president and dean who are members of that faculty, meaning by department, as a rule, what used to be meant by chair. Where the faculty of a school or college is small, as in the case of most law schools, the entire faculty of the school should be consulted. I do not mean that a formal vote of the faculty of the school or department need be taken either in making the appointment or in severing the relationship; but the actual sentiment of the faculty should be voiced in either action and when this is the case the action of the Board who are not educational experts, should be merely formal.

Mr. V. H. Henderson, secretary of the regents of the University of California, says:

For a new managing board to declare all positions vacant and to reappoint whom they see fit, is apt to prove a mistake. A wholesale violence of this sort has been proved by the history of American university life ordinarily to result in weakening an institution and hindering its healthy and normal development. As a matter of university planning it is very much better if a managing board shall not itself be a "new board"—that is to say, the governing board should be made up of a body of men whose terms expire at different times, so that the board shall always contain a considerable proportion of members who are thoroughly acquainted with the work of the institution and sympathetic with the purposes and ideals of American university work.

Mr. Henderson then makes the same point as does President Hill:

In the University of California, all initiative as to appointments, promotions, salaries and changes of title is with the president of the university. He invariably obtains the approval of the finance committee of the regents to the creation of a new position, or to changes which involve increase of expenditure, but the initiative in these matters remains with him and questions of personality remain with him. That this should be the case is an essential for the best success of any educational institution, whether it be a university or a city school system.

Mr. Henderson strikes at the basis of much of the trouble in regard to tenure. Where governing boards consider it their duty to take the initiative in the appointment or retirement of members of the faculty without the approval of the president, trouble is certain to ensue. With the formation of single boards governing all a state's educational institutions, a system now being tried in several states, this policy becomes all the more necessary, for it will be entirely impossible for members of such boards to have much personal knowledge of the fitness of the candidates.

I have endeavored to present to you the prevailing custom upon these matters in the land-grant colleges. Evidently, there is a considerable divergence of policy among the several institutions, the smaller of which may sometimes need to pursue a somewhat different course from that found satisfactory to those enjoying larger resources. However, it would seem fairly evident that there are certain general principles concerning the matter of definiteness of appointments and tenure which should be observed by all. If these could be clearly formulated by our committee on college organization and policy, and then be adopted by this section, would not such action be of considerable value in encouraging a more uniform practise and be a most welcome support to many of our college executives?

E. D. Sanderson
College of Agriculture,
West Virginia University

THE PORTO RICO SURVEY

The New York Academy of Sciences has begun a scientific study of the island of Porto Rico along the lines of geology, paleontology, zoology, botany, anthropology and oceanography. With the assistance of a friend, the academy has voted to expend $1,500 a year for five years on this work, and cooperation with the academy has been assured by the American Museum of Natural History, the New York Botanical Garden and by scientific depart-

ments of Columbia University, New York University and other institutions. Furthermore, on account of the representations made by the academy through its representatives, Professors Henry E. Crampton and N. L. Britton, the insular government of Porto Rico has made an appropriation of $5,000 toward the work for the fiscal year beginning July 1, 1914, with the expectation that this appropriation would be repeated on each ensuing four years.

The committee having the work in charge consists of Professors N. L. Britton, James F. Kemp, Franz Boas, C. L. Poor and H. E. Crampton. In furtherance of the project, Professor Crampton visited Porto Rico in December and January and Professor Britton and Dr. Lutz in January and February last, and the work is now well under way. Some of the aspects of the work are as follows:

GEOLOGY

Not much is known in detail about either the geology or the paleontology of Porto Rico, so that the field is very attractive. Much, too, remains to be done on the economic geology of the island. The geological portion of the scientific study of Porto Rico will be begun this summer by Professor Charles P. Berkey, who expects to sail for Porto Rico about the middle of August and to spend a month in reconnaissance work on the island. He will probably be accompanied by some other member of the New York Academy of Sciences. Dr. Berkey plans to cross and recross the island at as many points as are available in the time; to gain a general idea of the run of the formations and collect as many specimens as possible. Next winter and in subsequent seasons the details of particular sections will be elaborated by other workers, and the mineral resources will be specially studied. Attention will also be directed with great care to the fossiliferous strata.

ZOOLOGY

In the department of zoology, the field is wide and varied, and the organisms to be investigated are especially numerous. The work was begun in January, when Professor Crampton completed a reconnaissance of the island in order to map out the different ecological regions for further intensive study. Dr. Frank E. Lutz was a member of Professor Britton's party which investigated the islands of Desecheo and Mona, as well as certain areas of the main island. His collections comprise 10,000 insects, and notable series of land molluscs and other forms.

During the coming summer Mr. Roy W. Miner will begin the detailed investigation of the invertebrates of the shores and estuaries, especially those of the harbors of San Juan, Ponce, Mayaguez and Vieques. The coral reefs off the southern and western shores will also receive attention. Mr. John T. Nichols begins the collection and study of the fishes of the same regions, working with Mr. Miner so as to correlate the studies in these two fields.

For the study of the rich division of entomology, three investigators will take the field. Mr. H. G. Barber and Mr. F. B. Watson leave New York on July 4, and Mr. Charles W. Leng will go to Porto Rico later in the summer. They will study intensively certain characteristic regions mapped out by Professor Crampton and Dr. Lutz. The entomologists of government institutions are cooperating with the survey in this department of activity.

BOTANY

The botany of Porto Rico is fairly well known along several lines, but much field work is still desirable for satisfactory knowledge of the fungi and the lichens, and additions to the known flora in other groups can doubtless be made by further exploration of regions of difficult accessibility. The reforestation of portions of the island is one of the most important economic problems of the colony. Several of the members of the scientific staff of the New York Botanical Garden have given much time to Porto Rico, and the results of their labors will be used in further research there by them. Dr. Britton visited the island in January and is going there again in August.

ANTHROPOLOGY

The anthropology of Porto Rico offers an attractive field of study not only in the ethnology of the present inhabitants, but also and more particularly along the lines of archeology. Much material has been gathered from the surface, but a broad field is offered in the investigation of anciently inhabited caves and in the scientific working over of numerous kitchen middens.

OCEANOGRAPHY

The oceanographic work falls naturally into two general divisions—physical and biological. In both of these divisions there is opportunity for new and very valuable research.

The physical division should include a study of the tides and of the ocean currents in the neighborhood of Porto Rico. The present tidal data consist of several short and disconnected series of observations—the longest series having been made at San Juan in 1899. Observations of ocean currents are few and crude—those of the *Blake* were obtained by comparing dead-reckoning positions of the vessel with observed positions.

Tidal observations could best be carried on by the establishment of self-registering gauges. These could be established at the principal harbors and continuous records for several months or a year obtained.

Current observations to be of value must be obtained by a properly equipped ocean-going vessel, and such a vessel could obtain in a short voyage results of extreme value. At the same time, the vessel could and should be equipped for biological study—the current observations and the deep sea dredging for animal life going on side by side. For these two branches of oceanographic work a vessel is absolutely essential.

The specimens which are collected will eventually find lodgment in the American Museum of Natural History, except for the "first set" of duplicates. These will be deposited with the authorities of Porto Rico for the inauguration of an insular museum, and the academy's investigators will take particular pains to insure the good quality and extent of this series. Edmund Otis Hovey

THE NINTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY

Professor Paul Welden, president of the congress, in a personal letter writes as follows:

1. The meetings will be held in St. Petersburg from the 8th to the 14th of August, 1915.

2. Excursions are to be made to Finland, Moscow, Kiew, Baku in the Caucasus, etc.

3. In addition to the usual addresses, systematic reviews of the work in particular fields (with discussions) are to be given by specialists, on the invitation of the committee of organization, to a greater extent than formerly.

4. Particulars as to receptions, entertainments, etc., can only be given later.

5. The question of reduced railway fares on the Russian railroads is now under consideration by the government.

6. No obstacles will be placed in the way of the journey of Jewish chemists to the Congress provided (*a*) that at the frontier, in addition to the vised passport (requisite for every passenger), cards of membership, signed by the president and honorary secretary of the congress shall be presented.

7. An announcement of the Ninth International Congress in English will be sent in the course of the next few days or weeks to North America and England.

THE RUSSELL SAGE INSTITUTE OF PATHOLOGY

At a meeting of the board of directors of the Russell Sage Institute of Pathology, held in New York on June 5, the following officers were elected:

President, Dr. D. Bryson Delaven.
Vice-president, Dr. Simon Flexner.
Secretary, Dr. Theodore C. Janeway.
Treasurer, Dr. Graham Lusk.

Appointments to the scientific staff were as follows:

Scientific director, Dr. Graham Lusk.
Medical director, Dr. Eugene F. Du Bois.
Chemist, F. C. Gephart, Ph.D.
Assistant, Dr. A. L. Meyer.

Dr. Lusk reported for Dr. Du Bois that 142 observations had been made upon patients and on some normal controls during the past year and a half, using the respiration calorimeter established in the second medical division of Bellevue Hospital. In certain individuals an exact agreement between the actual heat production and the heat calculated from the gaseous exchange during hourly periods, was obtained for the first time in man. In the total of all experiments involving the measurement of 23,000 calories, these two methods of direct and indirect calorimetry agree both in health and disease within 1¼ per cent. The investigated cases included nine cases of typhoid during both fever and convalescence, one cretin, seven cases of exophthalmic goiter, one of splenic anemia, another with pernicious anemia, one man with acromegaly, one with hypopituitarism, one with malaria, and one with auricular fibrillation, mitral stenosis and greatly enlarged heart.

SCIENTIFIC NOTES AND NEWS

DR. ROBERT S. WOODWARD, president of the Carnegie Institution of Washington, will give the address on the occasion of the dedication on July 10 of the new laboratory building of the Marine Biological Laboratory at Woods Hole.

THE Croonian lecture of the Royal Society was delivered on June 11, by Professor E. B. Wilson, of Columbia University, on the bearing of cytological research on heredity.

THE Franklin Institute of Philadelphia has awarded its Edward Longstreet medal of merit to Dr. W. J. Humphreys for his paper on "Volcanic Dust and Other Factors in the Production of Climatic Changes and their Possible Relation to Ice Ages," which appeared in the August, 1913, issue of its journal.

THE triennial Parkin prize of $500 of the Royal College of Physicians of Edinburgh, has been awarded to Dr. Johnson-Lavis for his work on the effects of volcanic action in the production of epidemic diseases in the animal and in vegetable creation, and in the production of hurricanes and abnormal atmospherical vicissitudes.

THE University of Manchester proposes to confer the following honorary doctorates of science: Professor W. H. Bragg, University of Leeds; Professor W. J. Pope, University of Cambridge, and Dr. J. E. Stead, Middlesbro'.

PROFESSOR R. G. D. RICHARDSON, of the department of mathematics at Brown University, has been elected to membership in the American Society of Arts and Sciences.

PROFESSOR R. C. ARCHIBALD, of Brown University, has been made a member of the editorial board of the *Bulletin* of the American Mathematical Society. Professor Archibald has also had a book by him on "The Lost Book of Euclid" accepted for publication by the Cambridge University Press.

THE Royal Society of Edinburgh has awarded the Neill prize to Dr. W. S. Bruce, in recognition of the scientific results of his Arctic and Antarctic explorations, and the Keith prize to Mr. J. Russell, for his investigations relating to magnetic phenomena in metals and the molecular theory of magnetism.

PROFESSOR A. W. GOODSPEED, director of the Randal Morgan Laboratory of Physics, University of Pennsylvania, has been granted leave of absence for the session of 1914–15. He leaves with his family for Germany on June 25.

PROFESSOR METCHNIKOFF, of the Pasteur Institute, is to be presented with a memorial volume to celebrate his scientific jubilee and his seventieth birthday.

DR. J. J. STEVENSON, emeritus professor of New York University, was entertained on May 28 at a dinner at Pottsville, Pa., by Mr. Baird Halberstadt. There were present a large number of those engaged in the mining industry, to which Professor Stevenson's researches have so greatly contributed. Among those who spoke were Dr. I. C. White, of the University of West Virginia, and representatives of the

Pennsylvania Geological Survey and of the coal industry.

At the meeting of the Cambridge Philosophical Society held on May 18, as we learn from *Nature,* the following were elected honorary members of the society: Dr. H. E. Armstrong; Professor J. Bordet, the University, Brussels; Madame Curie, the Sorbonne, Paris; Professor F. Czapek, the German University, Prague; Professor T. W. Edgeworth David, the University, Sydney; Colonel W. C. Gorgas, Medical Corps, U. S. A. Army; Professor P. H. von Groth, the University, Munich; Professor Jacques Hadamard, the Collège de France, Paris; Dr. G. E. Hale, director of the Mount Wilson Solar Observatory; Dr. François A. A. Lacroix, Natural History Museum, Paris; Professor C. Lapworth, late professor of geology, the University, Birmingham; Professor H. Lebesgue, the Sorbonne, Paris; Dr. Jacques Loeb, the Rockefeller Institute, New York; Professor Arthur Looss, the Government School of Medicine, Cairo; Professor H. A. Lorentz, the University, Leyden; Professor M. Planck, the University, Berlin; Lieut.-Col. Leonard Rogers, the Medical College, Calcutta; Professor Gustav Schwalbe, the University, Strassburg; Dr. Karl Schwarzschild, the University, Berlin; Dr. D. H. Scott, foreign secretary, Royal Society; Professor E. B. Wilson, Columbia University, New York; A. F. Yarrow, Blanefield, Glasgow; Professor P. Zeeman, the University, Amsterdam. The society will celebrate in 1919 the centenary of its foundation.

Dr. W. H. R. Rivers has been appointed to represent the University of Cambridge at the nineteenth International Congress of Americanists to be held at Washington in October next.

The Hon. Bertrand A. W. Russell, lecturer in Trinity College, Cambridge, has been elected Herbert Spencer Lecturer for the year 1914–15 at Oxford.

Sir Joseph Wilson Swan, known for his important discoveries in connection with the carbon filament lamp, electro-chemistry and photography, died on May 27, in his eighty-sixth year.

Dr. Philip Henry Pye-Smith, a distinguished London physician and man of science, died on May 23, at the age of seventy-five years.

The death is also announced of Dr. George Dean, regius professor of pathology in the University of Aberdeen.

The U. S. Civil Service Commission announces an examination for an assistant physicist, qualified in metallography, to fill a vacancy in this position in the bureau of standards, Department of Commerce, Washington, D. C., at a salary of $1,400 to $1,800 a year.

The magnetic survey yacht *Carnegie* left Brooklyn, on June 8, under the command of Capt. J. L. Ault, for a cruise in the North Atlantic Ocean to Norway (Hammerfest) and Iceland. The vessel will return to Brooklyn again about December 1.

The schooner *George B. Cluett,* of the Grenfell Association, has been chartered by the department of terrestrial magnetism of the Carnegie Institution of Washington for a cruise to Hudson Bay this summer. The expedition will be in charge of W. J. Peters, assisted by D. W. Berky, and will leave Battle Harbor, Labrador, on July 1.

Owing to the fact that the Cartier celebration will be held in Montreal during the week beginning on September 6, and the resultant congestion of hotel and transportation facilities, the meeting of the American Chemical Society in that city has been changed to September 15–18.

The seventh congress of the International Association for Testing Materials will be held under the patronage of the Czar of Russia, in St. Petersburg, on August 12–17, 1915. After the congress extensive excursions in the interior of Russia have been arranged.

By the will of Harris Charles Fahnestock, of New York, $550,000 is bequeathed to New York city hospitals and charities.

THE Council of Mathematical Teachers in New England has recently appointed a special committee on the status and welfare of mathematics in secondary schools, to investigate and report on current criticisms of high school mathematics. The membership of the committee is as follows: Mr. G. W. Evans, Charlestown High School; Professor F. C. Ferry, Williams College; Mr. A. V. Galbraith, Middlesex School; Mr. F. P. Morse, Revere High School; Mr. C. D. Meserve, Newton High School; Professor S. E. Smith, Mount Holyoke College; Miss H. R. Pierce, Worcester High School, and Professor H. W. Tyler, Massachusetts Institute of Technology, *chairman*. Correspondence with persons having special information is invited.

A CONVENTION of Tau Beta Pi, the honorary engineering society, will be held in Ithaca on June 11, 12 and 13. One delegate from each of the twenty-seven chapters and the five alumni chapters will attend. The general program includes business meetings on each of the three days and numerous excursions and social meetings.

As we have already announced there will be held a celebration on July 24 to 27 under the auspices of the Royal Society of Edinburgh, of the tercentenary of the publication of Napier's "Mirifici Logarithmorum Canonis Descriptio," the work which embodies the discovery of logarithms. Lord Moulton will deliver the presidential address on July 24; and many distinguished mathematicians, astronomers, actuaries and engineers will make communications on July 25 and 27. An exhibition of calculating machines, apparatus and books, and of objects associated with Napier and the history of mathematics, will be held in connection with the celebration. Immediately following a mathematical colloquium will be held on July 28 to 31, under the auspices of the Edinburgh Mathematical Society. The following courses have been arranged for in connection with the colloquium: Two lectures on Nomography, by M. d'Ocagne, professeur à l'Ecole Polytechnique, Paris; four lectures on Infinity in Geometry, by H. W. Richmond, King's College, Cambridge; four lectures on Critical Studies of Modern Electric Theories, by E. Cunningham, St. John's College, Cambridge; two lectures on The Solution of Algebraic and Transcendental Equation in the Mathematical Laboratory, by E. T. Whittaker, professor of mathematics in the University of Edinburgh.

UNIVERSITY AND EDUCATIONAL NEWS

AFTER several months' investigation the plan of the presidential commission for national vocational education has been presented in the senate in a bill introduced by Senator Hoke Smith, one of the commissioners. It proposes an expenditure by the federal government of $1,500,000 next year for the salaries of teachers of agriculture, trade, industrial and home economics. The amount would increase automatically each year until 1924, when the total would reach $7,000,000. An equal amount must be expended by states. A federal board of vocational education would consist of the postmaster general and the secretaries of interior, agriculture, commerce and labor. State boards of not less than three members each would be provided.

THE Sheffield Scientific School, Yale University, has received a provisional gift from a graduate of $100,000. This gift is contingent upon the securing of an additional $100,000; the money to be used for the development of a graduate course of one year, and, if possible, two years, as an addition to the present undergraduate course known as the select course, in preparation for business and business administration.

AT the annual commencement of Gustavus Adolphus College, St. Peter, Minnesota, announcement was made of the completion of an endowment fund of $250,000. The two largest contributors were James J. Hill, of St. Paul, and C. A. Smith, of Minneapolis, each of whom gave $50,000. On the same occasion Oscar J. Johnson was formally inducted into office as president of the institution.

It is announced that the Carnegie Foundation for the Advancement of Teaching has undertaken to grant pension allowances to the director and faculty of the Carnegie Institute of Technology and also to the directors of the Carnegie Museum and the Carnegie Department of Fine Arts, and such of their curators as do teaching work, under the rules and regulations of the foundation.

The School of Physiology, presented to the University of Cambridge by the Drapers' Company was opened by Prince Arthur of Connaught on June 9. The cost of the building, with the contribution made by the company towards its equipment, has amounted to £23,500.

On June 3 the University of Missouri celebrated the seventy-fifth anniversary of its founding. Addresses were delivered on this occasion by former Governor David Rowland Francis, president of the board of curators, Albert Ross Hill, president of the university, the Hon. William Rock Painter, lieutenant governor of Missouri, the Hon. William Prentiss Evans, state superintendent of public schools, Frederick Aldin Hall, acting chancellor of Washington University, David Francis Houston, secretary of agriculture, Harry Burns Hutchins, president of the University of Michigan, and Cassius Jackson Keyser, professor of mathematics in Columbia University. On the following day, President Lowell, of Harvard University, delivered the commencement address, and the degree of doctor of laws was conferred on President Lowell, Secretary Houston, Professor Keyser and Mr. William Mack.

Dr. Arthur Kenyon Rogers, professor of philosophy at the University of Missouri, has been called to Yale University to succeed Professor William E. Hocking, who goes to Harvard University.

Assistant Professor William D. Harkins, of the department of chemistry at the University of Chicago, has been promoted to an associate professorship in chemistry.

Dr. C. H. Shattuck, head of the department of forestry at the University of Idaho, was recently elected dean of the college of letters and sciences of that institution.

Miss Jessie Y. Caun, Ph.D. (Columbia), head of the department of chemistry, Rockford College, Rockford, Ill., has accepted an instructorship in chemistry at the University of Illinois.

DISCUSSION AND CORRESPONDENCE

SOVEREIGNS AND THE SUPPOSED INFLUENCE OF OPPORTUNITY

A serious criticism has been made of my theory that the high intellectual qualities found in royal families are the results of natural and sexual selection and inherent in differences in the germ-plasm. My belief is that differences of opportunity may have played some rôle, but my contention is that all the evidence we possess points in the opposite direction, and the conclusion is that differences in opportunity have been on the whole of comparatively trivial importance.

One of the eight reasons in support of this theory, which I have given in "The Influence of Monarchs" (New York, 1913), page 258, is that "younger sons of kings are not less eminent than heirs to the throne." By eminent I mean of high intellectual grade. For this statement I drew upon statistics published in "Heredity in Royalty" (New York, 1906), page 285, and again here presented in Table I. below.

TABLE I

Grades.....	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Total
Total number in each grade.....	7	21	41	49	71	70	68	43	18	7	395
Succession inheritors	5	14	26	31	49	38	45	23	12	4	247
Per cent.....	71	67	63	64	69	54	67	54	67	57	62.5

These 395 persons were the 395 adult males 25 years or over who were graded for intellect in "Heredity in Royalty," pages 20–26. About three fourths of these individuals belong as descendants in the direct male lines of families studied. The other quarter enter the lists as ancestors, usually direct ancestors, in the various maternal lines. As far as one

can see from this table there is no tendency for the mentally superior grades (8), (9), (10) to be filled with succession inheritors.

It is thus seen that from 54 to 71 per cent. inherited the succession in the different grades. The upper grades are in no way composed of men whose opportunities were enhanced by virtue of this high position. Thus we see that a certain very decided difference in outward circumstances—namely, the right of succession—can be proved to have no effect on intellectual distinction, or at least so small as to be unmeasurable without much greater data.

The criticism which I have received comes in the form of a private letter from Professor J. McKeen Cattell and is so much to the point that it has called for the reinvestigation which I am here giving. The criticism is as follows:

It seems to me that the figures in your table ("Royalty," p. 285) may be explained by the fact that the monarchs attaining (9) and (10) come from a smaller group than those who are not monarchs. The encyclopedias would note all those attaining ranks (9) or (10) whether monarchs or not. The heredity being the same, the non-monarchs should, on your hypothesis, supply a larger number in these grades. As the monarchs supply one half of the (9) and (10) grades (there appears to be an error in the percentage under (9)[1]) it follows that their grade was increased by their office. In grades (1) and (2), on the other hand, monarchs would be more likely to be included than other members of royal families.

It will be at once seen that this criticism is directed towards two points which I had not at that time determined—(1) what are the chances that an adult male member of the families studied will succeed to the throne. In other words, what is the per cent. of sovereigns to non-sovereigns when all adult males are considered? (2) What allowance should be made for the "obscure" princes or sovereigns? How many of these are there and is their presence such as to introduce a significant error?

It is not surprising that one unacquainted with royal genealogies should suppose that the total number of reigning sovereigns should be less than the total number of younger brothers (non-inheritors of the succession). The House of Hanover in modern England would give one this false impression. Here 20 adult males furnish but 6 reigning sovereigns. But the precise record of all the direct lines included in my study shows that this is a marked exception. On the average a little more than half of the males (who live to be 25 years) have become reigning sovereigns by inheritance. This is due to the fact that, in spite of the high fecundity in royal families. during the period studied, the adult males average only between 2 and 3 (2.33 in Table II.) in each "fraternity." There are many instances where a sovereign succeeds his brother, and this brings the proportion to more than one in two.

The percentage 62.5 for succession inheritors, in the table given above, is somewhat higher than that given for the table below perhaps in part because the table above included maternal grandfathers. These are sometimes of houses of less importance and grandeur than the great houses that form the chief male lines. It is probable that they are not often younger sons, consequently they are more apt to be sovereigns. Be that as it may it makes no difference since an accurate and systematic table is now prepared. These figures which are given below (Table II.) deal with the 832 adult persons who are in the male lines in "Heredity in Royalty." 403 of these are males. 220 or 54.6 per cent. became sovereigns by inheritance. The genealogy which I have used is the exhaustive and authoritative "Genealogie der in Europa regierenden Fürstenhäuser" by Dr. Kamill von Behr. It contains the direct lines of all the "Reigning Sovereigns" families of the present day. These are the same as found in the "Almanach de Gotha," Première Partie, but the "Genealogie" of von Behr traces them back as far into the past as possible. Von Behr does not include the non-reigning families, found in the "Almanach de Gotha," Deuxième Partie. These mediatized German royal families have the rights of equality of

[1] This is a typographical error. The 8 should read 12.

birth with the reigning sovereign houses, but have not reigned since the Napoleonic era. It is easy to tell the actual sovereigns in von Behr as they are printed in capital letters. These are not always kings; a few are of ducal and princely royal houses, but even here some inherit the succession as sovereigns while others do not. With the exception of Montmorency (6 members) all the persons in the following tables are of strictly royal families.

Of the 403 persons in Table II., 94 are "obscure"; that is, not enough could be easily found out about them to warrant grading them for intellect in a scale of 10. More careful researches than I have yet been able to make, would doubtless reduce the number

TABLE II

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Sovereigns by inheritance.....	5	9	24	23	44	30	39	16	7	4	201
Non-sovereigns....	1	9	9	12	18	22	16	12	6	3	108
Probable distribution of "obscure" sovereigns.....			1	7	10	1					19
Probable distribution of "obscure" non-sovereigns...	1	2	11	20	32	7	2				75
Corrected sovereigns.....	5	9	25	30	54	31	39	16	7	4	220
Corrected non-sovereigns.....	2	11	20	32	50	29	18	12	6	3	183
Per cent. of sovereigns.....	71	45	56	48	52	51	68	57	54	57	54.6

of the "obscure," but I have always felt that this was not necessary to secure the conclusions which have been obtained. It is not necessary to secure the heredity correlations, and now it appears that the error which this introduces is not significant for the present inquiry. Of these 94 obscure members, 19 are sovereigns and 75 are non-sovereigns. The sovereigns are almost certainly and non-sovereigns probably, not worthy of grades (8), (9) or (10). They would probably form a curve of distribution about the grades (4) and (5). The non-sovereigns would find their center a little higher and spread out a little more. They are approximately arranged in the third and fourth horizontal columns.

Now it can be seen that grades (3), (4), (5) and (6) as they appear in the uncorrected horizontal columns, at the top of Table II., will stand the introduction of a number of non-sovereigns without dimissing the 54.6 per cent. which is the average. Can these 94 "obscure" members be placed in Table II. without overbalancing the results? The reader will see that they can. For although the 75 "obscure" non-sovereigns count against my thesis, the 19 "obscure" sovereigns count in its favor; and all added together give a confirmatory result. In the previous investigation there were about 62 per cent. in each grade, who were sovereigns; now there are about 54. The truth of the whole matter is, that while there are, in the second research, a large number of (4) and (5) grades among the sons, in the previous research these mediocre persons were represented in the ancestry. The previous statistics could not settle the question of how many there were who were "obscure." The present research does settle the point, since it takes them up one by one and counts them all, in a series of "fraternities" one generation after the other.

Those who look carefully will see that there is a slight tendency for the sovereigns to run to the higher grades, but such a tendency is negligible for two reasons, even if a much larger total should make it exceed the probable error. Those who have inherited the throne must, on the average, have lived slightly longer than those who have not. A long life must favor the chances of inheritance. If the sovereigns have been longer lived, then they have had that much more time in which to distinguish themselves. Another point is that for all forms of genius (painters, poets, scientists, authors, etc.) and for the mentally abnormal as well, it has been claimed that the probabilities favor the firstborn beyond chance expectation. But some of these results have been questioned.

At any rate this does not concern the contention which I have made that there is no marked or easily measurable influence of opportunity on sovereigns, at least as arising from their official position.

Here then is an attempt to measure the rela-

tive influence of heredity and environment, not in a general, but in a special way. As I have been pointing out for several years, "the heredity *versus* environment" muddle can not be clarified except by making everything into problems of differences.

The study of the lower organisms may give for human heredity, very erroneous conclusions. The lower organisms are much more modified by environment than are the higher. If we are to make the science of eugenics accurate and accumulative, we must in every case, first decide what human differences, because of their importance, are interesting; then keeping the heredity factor constant, we should experimentally alter the environmental; or keeping the environmental the same, experimentally alter the heredity.

There can be no general answer to the time-honored controversy; but there may be a special answer to each separate, pragmatically conceived question. There may or there may not be. We can not tell until we try.[2]

Here it is not a general question whether opportunity has had any influence or not. It is a special one. Have we a right to say that there have been proportionately more great men among kings than among commoners because of the environment of kingship? The answer is that as far as we know at present the differences of environment have had absolutely nothing to do with it.

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OCCURRENCE OF BACTERIAL BLIGHT OF ALFALFA IN THE SALT LAKE VALLEY, UTAH

THE bacterial disease of alfalfa studied by Sackett[1] in Colorado has already done considerable damage in the Salt Lake Valley, Utah. So far as the writer knows, this disease, which is due to *Pseudomonas medicaginis* Sackett, has not been definitely reported from Utah, although Heald[2] states that "what appears to be a similar disease has also been reported from Utah, New Mexico, Nebraska and Kansas." There is sufficient evidence to warrant the statement that the bacterial blight of alfalfa has been prevalent in the Salt Lake Valley for some time, and, no doubt, the poor stands, as well as the many weak plants, are due to this disease. It is certain that this disease has caused more injury than the crown gall disease [*Urophlyctis alfalfæ* (v. Lagerh.) P. Magnus], recently reported by the writer as occurring in the Salt Lake Valley, and is certainly as injurious as the alfalfa weevil (*Phytonomus murinus* Fab.). In the past this disease has been mistaken for smoke injury due to the smelters, and it has also been reported as "alkali burn." That this disease could have escaped notice is singular, because the symptoms are as definite as those of the pear-blight disease.

The water-soaked, semi-transparent, yellowish to olive-green appearance of the stems, together with the presence of small droplets of a thick bacterial ooze and the weakened and partially drooping plants are the unmistakable symptoms of the disease in the incipient stages. Finally the stems become brownish-discolored or blackened, and very brittle. When the stems are attacked the foliage soon becomes chlorotic, finally turning a dirty white in severe cases. The leaves then become dry and brittle. When small pieces of the tissue of the diseased stems or leaves are mounted in water on a slide, enormous masses of the organisms may be seen by the naked eye issuing from the tissues. There is absolutely no difficulty in securing pure cultures.

The presence of the alfalfa weevil in the Salt Lake Valley is a factor in the distribution of this disease. While it is known that stomatal infections may occur, by far the greater number of infections take place through openings in the epidermis produced by insect punctures and severe frost injury. It has been noted that

[2] For a fuller discussion see "Separating Heredity from Environment," *American Breeders Magazine*, Vol. II., No. 3, 1911, and "The Influence of Monarchs," pp. 227–229 and 290–293.

[1] Society American Bacteriologists, Boston meeting, December, 1909. SCIENCE, N. S., XXXI., 553, 1910. Colorado Agricultural Experiment Station Bull. 158, 1910.

[2] Phytopathology, Vol. II., No. 1, page 12.

where the disease is present in a field the greater infection occurs where the alfalfa weevil is also present. This disease is so injurious that fully 80 per cent. of the first cutting may be lost on account of it. However, while the chief damage is usually noted in the first cutting, the plants may be seriously injured in the crowns and roots, thus causing entire plants to be killed.

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Salt Lake City, Utah,
May 16, 1914

Further Notes on Tamarisk

Judging from Mr. Carleton's remarks[1] and the writer's experience *Tamarix gallica* is another of those interesting plants that will grow in very dry as well as in exceedingly wet places. This species is extensively planted at Belle Isle, Vermillion Parish, in the broad coastal marsh of Louisiana. The soil here is always saturated with water and is subject to inundation by exceptional tides. The plant is known as salt-water cedar, and its main use is for firewood. Little of that commodity is needed in this austral locality, and sections of the limbs of *Tamarix*, in size from the thickness of a finger to that of the wrist, answer every purpose. The plants are pollarded and closely pruned but quickly produce a new crop of firewood.

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A Factor for the Fourth Chromosome of Drosophila

A new character has recently appeared in *Drosophila* in which the wings are "bent." The factor concerned does not fall within any of the three groups of linked factors so far described. There are four pairs of chromosomes in *Drosophila* (without taking into account possible complications of the *XY* pair). The number of chromosomes now corresponds therefore with the number of independent groups of factors. The correspondence goes even further than number, however, for the sex-linked group is known to be distributed with the *X* chromosome, and all the groups correspond in their size-relations with the chromosomes, there being three large groups and one small, just as in the case of the chromosomes. The factor for "bent" forms the small "group" by itself, and accordingly may be considered to lie in the small chromosome.

Hermann J. Muller

[1] Science, N. S., XXXIX., pp. 692–694, May 8, 1914.

Dickerson[1] on California Eocene

Two brief but valuable papers by Mr. Dickerson call attention to the fact that the apathy with which the Eocene of California has been treated since Gabb's time is less on account of any last word having been said on the subject than the overshadowing economic importance of the later Tertiary horizons of the state.

The use of the name Tejon to embrace all the post-Martinez Eocene of the Pacific coast and the recognition of the section south of Mt. Diablo as a standard for this formation can hardly meet with general approval. It appears that this section is composed exclusively of beds belonging to a formation stratigraphically younger and separated from the horizon at the type section in the Canada de las Uvas near Fort Tejon by several thousand feet of strata as well as a considerable time gap.

The writers[2] have shown that in Oregon and Washington the Eocene may be divided into three faunal divisions, the Chehalis, Olequa, and Arago or Ione formations. The

[1] Dickerson, Roy E., "Fauna of the Eocene at Marysville Buttes, California," Bull. Dept. Geol. Univ. of California, VII., p. 257–298, Pl. XI.–XIV., 1913; "Note on the Faunal Zones of the Tejon Group," *loc. cit.*, VIII., No. 2, p. 17–25, 1914.

[2] Arnold, R., and Hannibal, H., "The Marine Tertiary Stratigraphy of the North Pacific Coast of America," *Proc. Am. Phil. Soc.*, LII., No. 212, p. 559–605, 1913.

Chehalis formation is characterized especially by *Venericardia horni* Gabb, *Meretrix californica* Gabb and an austral flora, the Olequa formation by *Pecten (Chlamys) landesi* Arn., *Venericardia horni* Gabb, and a tropical flora, and the Arago or Ione formation by *Turritella merriami* Dickerson, a form of *V. horni* with obsolete ribs (variety *aragonia* A. & H.) and a tropical flora.

The Chehalis and Olequa horizons lie in juxtaposition, and constitute the coal-bearing Eocene of western Washington. The upper or Olequa horizon has not been definitely recognized in Califoria, but the lower or Chehalis horizon is the apparent equivalent of the Eocene of New Idria, Salt Creek, Coalinga, Canada de las Uvas, Simi Valley, Topa Topa Mountain, Santiago Canyon, and presumably Rose Canyon near San Diego, as well as the plant-bearing shales near Lake Elsinore.

Looking at a map of the Pacific coast, it is evident that these deposits were formed in two embayments. The Puget Basin covered western Washington from the south base of the Olympic Mountains to the Columbia River, an arm reaching northward to Vancouver, British Columbia, while the main body extended inland to the foot of the here more recently developed Cascade Range and probably farther, for the Swauk formation of central Washington apparently represents deposits formed near the east margin of the same great stretch of marsh and estuary. The Tejon basin covered the San Diego mesa, the Los Angeles coastal plain, and crossed the San Gabriel and Santa Ynez Ranges in a long arm extending into the San Joaquin Valley and northward through the Coast Ranges as far as New Idria. As the deposits are usually more or less marine in origin, it is evident that this embayment was rather of the type of an open roadstead than the partly detached brackish estuary in which the Washington deposits were formed.

The Arago or Ione beds represent a horizon younger than any Tejon recognized in the Tejon or Puget basins. They do not occur in juxtaposition, but are developed in different districts, lying indiscriminately across older rocks. The Arago or Ione beds have been recognized in three basins, the Crescent basin, a narrow arm extending inland along the north base of the present Olympic Mountains to the vicinity of Port Crescent, Washington; the Arago basin, a broad open roadstead covering the Coast Range, Williamette Valley, and Umpqua basin of Oregon, the marine deposits of the south and west being gradually replaced to the north and east by débris from the Eocene volcanoes of the Cascade Mountains; and the Ione basin which extended inland between the north terminus of the Mount Hamilton Range and the higher Coast Mountains of northern Lake County, to lap the base of the Sierra Nevada. This embayment spread southward through the San Joaquin Valley to Pacheco Pass and San Joaquin Canyon, and north to Oroville and perhaps beyond. Most of the deposits were laid down in a sea of considerable depth as shown by the glauconitic sandstones and the paucity of coal beds, but there is a tendency for the marine beds of the eastern border at Merced Falls, the Mokelumne River south of Ione, and South Oroville Table Mountain to grade up into the rhyolitic tuffaceous plant beds between Ione and Carbondale and at Oroville Table Mountain, while in the district about the Big Bend of Pit River only deposits of the latter type are known.

As already noted, the Tejon type section in the Canada de las Uvas was taken in beds of the Tejon embayment, and since the name Tejon series has always been used in a loose sense the writers have proposed to retain it in such a way as to cover the Chehalis and Olequa formations of the Puget embayment, as well as the deposits of the Tejon embayment.

The Arago or Ione beds, occurring as they do in basins distinct from those in which the Tejon series is developed and being formed at a different period, must be treated as a distinct division of the Eocene. The earlier name is the Ione formation,[3] the Arago having been given several years later.

[3] The gravels underlying the mud flows of Marysville Buttes often mapped as Ione are of very much later age.

If the section south of Mt. Diablo is considered as a standard for the Ione of California it would be interesting to see whether the divisions admitted by Dickerson may be recognized elsewhere. The series is at many points, especially in southern Oregon, extremely thick, and might easily include more than one faunal horizon as yet unrecognized.

On the whole the writers are in hearty accord with Mr. Dickerson's results. A most valuable point brought out is the discussion of the depths of the water in which the various beds were deposited. It should be the incentive to further studies of this sort which have been altogether too much neglected.

Ralph Arnold,
Harold Hannibal

SCIENTIFIC BOOKS

Artificial Parthenogenesis and Fertilization. By Jacques Loeb. The University of Chicago Press, Chicago, Ill. 1913. Pp. viii + 306. 39 tables and 86 figures. Price $2.50 net; $2.68 post-paid.

As stated in the preface, "Artificial Parthenogenesis and Fertilization" is in reality the English translation of an earlier work, "Die Chemische Entwicklungserregung des Tierisches Eies," enlarged and brought up to date by incorporation of the recent research in the field of development. The realm of artificial parthenogenesis is not a narrow one, by any means. It involves problems of wide physiological interest, the action of ions on tissues, the natural death of cells, immunity, hybridization and organic oxidation, a process coextensive with life itself. Thus we have chapters devoted not only to the history and methods of artificial parthenogenesis, but on "The Relative Physiological Efficiency of Various Isosmotic Solutions"; "Chemical Constitution and Relative Physiological Efficiency of Acids"; "Condition for Maturation of the Egg"; "Heterogeneous Hybridization"; "Hydrolytic Processes in the Germination of Oil-containing Seeds," etc. The chapters contain a mass of detailed results, chiefly those of the author, obtained by almost continuous experimentation over a period of fifteen years. Each is a model of what the experimental method should be—the observation of certain facts, the formation of provisional hypotheses to explain these observations and, most important of all, the subsequent testing of the hypothesis by experiment. Only in this way can a mass of unrelated details be welded together into a logical whole presentable to the general reader, as well as the special student of the field of development.

The more recent discoveries are naturally of greatest interest. One is impressed in reading Loeb's book, with the great variations in the conditions for development among closely related forms—variation in factors which we should expect to be fundamental and universal. Thus we find that the eggs of *Strongylocentrotus purpuratus* do not develop in neutral sea water, but only in slightly alkaline sea water, whereas the eggs of *Arbacia punctulata* develop not only in neutral, but even in a slightly acid medium. The response of eggs to different methods of artificial parthenogenesis varies greatly. All gradations occur from species which are normally parthenogenetic or occasionally parthenogenetic through those ready to respond to any method, even mechanical agitation, to forms developing only after very special treatment or not responding to stimulation of any kind.

A similar variation exists in regard to the oxidative process, which is of particular interest for the theory of development. The rate of oxidation in sea-urchin eggs increases sixfold after sperm fertilization or artificial fertilization. Apparently the sea-urchin egg has come to a rest because something inhibits its oxidations and the sperm can set them going again, with consequent development. With this hypothesis in mind we turn to the starfish egg, only to find that here the oxidations do not increase after the sperm has entered. The starfish egg undergoes a certain amount of development, maturation, in sea water and then comes to rest. The entrance of sperm or treatment of some

kind is then required to continue development despite the fact that the oxidations are going on to their fullest extent. That it is their fullest extent is indicated by the interesting fact that even complete cytolysis of an egg by saponin will not further accelerate its rate of oxidation.

Loeb analyzes the effect of the sperm in initiating development into two factors—first, the sperm contains a lysin, not readily diffusible into the egg of the same species, but readily so into eggs of other species, which produces a surface cytolysis. The surface cytolysis leads to membrane formation in eggs which form fertilization membranes as part of their normal development. Foreign cells and foreign fluids may contain similar "lysins," but eggs are immune to lysins of cells of the same species because they are impermeable to them. Hence they must be carried in by actual penetration of the spermatozoon. In most eggs, especially sea urchins, a second substance must also be carried into the egg to prevent the destructive effect caused by superficial cytolysis. Some eggs, *Asterina, Polynoë* and *Thalassema,* do not require the second corrective factor, due possibly to the fact, as Loeb suggests, that they already contain it or automatically form it. Again we note variability in an apparently fundamental point. The effect of the lysin is imitated by the various membrane-forming substances which if too concentrated lead to complete cytolysis of the egg. The effect of the second substance is imitated by the various correcting agencies, hypertonic sea water, low temperature or a prevention of oxidations by KCN and chloral hydrate.

The lysin, the membrane-forming substance, is the essential in causing development. How does it act? At present only suggestions can be made. A possible method and a very simple one would be the removal of some substance which prevents development. This view which has been suggested and discussed by Loeb and other authors seems the most probable one to-day. The problem of fertilization becomes as much a question of what causes the egg cell to cease development in a certain stage as of the cause for its further development by the entrance of a spermatozoon. In physiological terms we may say that the stoppage of development appears to be due to an inhibiting substance, that it is an auto-narcosis. The lysin in the sperm or any artificial method of causing development, even the prick of a needle, allows the inhibiting substance, the narcotic, to pass out. This result is possibly obtained, although Loeb does not definitely uphold this view, through increase in permeability of the egg. As already mentioned oxidations are not diminished in the resting condition of the starfish egg and it is interesting to note, as shown by Loeb, that oxidations in artificially narcotized cells are likewise not diminished. Narcosis is not due to asphyxiation but is probably due to decreased permeability. Certainly research along the line of cell permeability, especially functionally conditioned changes in permeability is the most promising field for a solution of the problem of development, as of many other biological processes.

The reader interested in developmental mechanics will be well repaid by a close study of Loeb's book. Here is collected in condensed and readable form the results of many years' study together with conclusions and ingenious hypotheses which stimulate to additional discoveries along these and other lines.

E. NEWTON HARVEY

PRINCETON, N. J.

Rocky Mountain Flowers: An illustrated guide for Plant-lovers and Plant-users: with twenty-five plates in color, and twenty-two plates in black and white. By FREDERICK EDWARD CLEMENTS, Ph.D., Head of the Department of Botany in the University of Minnesota, and State Botanist; Director of the Pikes Peak Alpine Laboratory, and EDITH SCHWARTZ CLEMENTS, Ph.D., Instructor in Botany in the University of Minnesota and in the Pikes Peak Alpine Laboratory. The H. W. Wilson Company, White Plains, N. Y., and New York City, 1914. Octavo, 392 pp. ($3.00.)

Tourists in the Rocky Mountains have waited long for such a book as this, and we hazard the guess that it will be eagerly accepted by them as the manual which will enable them to recognize and name the flowers they find on the high plains and in the mountain canyons. For such people the colored plates of approximately two hundred species, and the black and white plates, of not far from three hundred more, will prove most helpful. But aside from tourists and other summer residents of the Rocky Mountains there is a still larger class of people who will welcome this attractive book. For, contrary to the opinion of many who have never crossed the Great Plains, there are schools and colleges and universities with their students and teachers interested in the plant life about them. And to these we may add an increasing number of people who are interested in plants because they love them. In fact, these great highlands of the United States are coming to contain very many people to whom such a book as this will appeal very strongly. We can not imagine a better book for the high school libraries of the west, or for that matter for the libraries of the western colleges and universities. The beautiful plates, which were made by the junior author, must appeal to every pupil with any esthetic sense, as they must also to many cultured people outside of the schools.

The chief features of the book are its general key to families, in which the treatment is distinctly non-technical, accompanied by a chart of relationship that should make the determination of the family relatively easy. Following these are the Dicotyledonous orders, and families, followed later by the Monocotyledonous orders and families, with keys, again, to the genera, and later to the species. Here a useful feature is emphasized in giving rather fully the etymology of the generic names, a matter that will be appreciated especially by those who are not privileged to be in the classes of scholarly teachers. Each genus is briefly characterized, and following this the species are indicated by a key in which as many descriptive features as possible are emphasized. In passing it should be pointed out that the plates always include related plants, so that family relationship is thus emphasized. The black and white plates, again, emphasize the more difficult species, notably those of the grasses and sedges. This fact will add much to the usefulness of the book.

An introduction of nine pages gives some idea of "the general lines of the evolution of flowering plants from the ancestral ferns," and suggests "the relationships of the various groups." The discussion leads up to the "chart of relationship" mentioned above.

In the preface the authors have something to say about "species" that will show the scientific reader that they have been thinking of the problem of species limits. Of course this preface was not written for high school pupils, nor indeed for the tourist of limited scientific training, but for botanists this short preface will be found to contain some suggestive thoughts.

We are told by the authors that the range of the book includes "Colorado, Wyoming, most of Montana, northern New Mexico, eastern Utah, and western North, and South Dakota, Nebraska and Kansas," and no doubt it may be profitably used in a considerable area oustide of these limits.

The authors are to be congratulated upon the successful completion of this notable work.

Charles E. Bessey
The University of Nebraska

The Life of the Mollusca. By B. B. Woodward. London: Methuen & Co. 1913. 12mo. Pp. xii + 158. Pl. XXXII., 1 map.

This volume is one of a popular series intended to summarize existing published knowledge on the subject of which it treats, and not to present fresh information or new researches. It is distinctly not ecological, and, perhaps in deference to British prudishness, omits the existing data on the reproduction of the pulmonates, a body of facts which have more bearing on the life of these mollusks and have been more thoroughly observed than any other phases of molluscan life.

The plan includes a (somewhat obsolete) system of classification, a chapter on geological history, one on distribution (such as can be obtained from existing manuals), on reproduction (omitting reproductive acts), on food, evolution, instinct, intelligence and uses, with an index.

Taken for what it is, a compilation from the literature for popular use, it should not be too harshly criticized, and in fact presents a useful compendium of widely scattered data, not elsewhere brought together.

It is well illustrated, chiefly by reproduction of the plates of the well-known "Manual of the Mollusca," by S. P. Woodward, first published in 1850, and in its time easily the best of the smaller manuals of the mollusca.

Taking into consideration the purpose of the book, the chief criticism which in justice to the reader we feel should not be suppressed, touches on the too ready acceptance by the author of some statements by others which stand in desperate need of confirmation.

For instance the assertion that the murices utilize the spur or projecting spine of the aperture of the shell to pry open bivalves which they intend to devour, is almost precisely on a level with the statement that a man can sit in his own lap, and would be possible only in space of the fourth dimension. In the most charitable view the author of this assertion united to a lively imagination very imperfect observation. Such notions touch the imagination of the ignorant, but have no proper place in scientific literature.

Also the assertion that the shell-bearing Pteropoda are derived (p. 56) from the *Bulla*-like Tectibranchs (originating with an anatomist of limited experience with mollusks) is hardly compatible with the ascertained facts that shell-bearing Pteropods occur in the Cambrian; while the Bulloid Tectibranchs first appear near the close of the Carboniferous (p. 47).

Here and there such questionable statements mar the generally high average of accuracy of this little compendium, but, on the whole, it will fulfil a useful purpose.

WM. H. DALL

PRINCIPIA ATMOSPHERICA

1. *Upper Air Calculus and the British Soundings during the International Week* (May 5–10), 1913. By W. N. SHAW. *Journal of the Scottish Meteor. Soc.*, Vol. XVI., No. XXX., p. 167.
2. *Principia Atmospherica.* A Study of the Circulation of the Atmosphere. *Proc. Roy. Soc. Edinburgh.* Read December 1, 1913.
3. *Principia Atmospherica.* An address before the Mathematical Society, January 7, 1914. Privately printed.
4. *The Interpretation of the Results of Soundings with Pilot Balloons. Quar. Jour. Roy. Meteor. Soc.*, April, 1914.

In these four recently issued pamphlets, Dr. W. N. Shaw, the progressive director of the British Meteorological Office throws wide open a new door in aerology through which we seem to catch sight of that great desideratum, the forecast based on definite laws, or perhaps it would be the part of wisdom to say, definite foreknowledge of the structure and energy distribution in "highs" and "lows" in connection with the flow of air at different levels.

It is only a short time since W. H. Dines, studying numerous upper air observations, came to the conclusion that the differences of pressure at the earth's surface were of the same order of magnitude as those at a height of nine kilometers and therefore the distribution must be regarded as controlled by conditions at the base of the stratosphere. In studying this remarkable result, Shaw examined the physical conditions necessary for the building up of pressure between points at the same level in two verticals and found that the difference in the influence of the stratosphere and troposphere is attributable to the characteristic difference of temperature. He establishes a formula for the increase of pressure difference per meter of height and a second equation which gives the gradient wind velocity at any level. This latter is used to explain the variation of wind velocity with height and in particular the falling-off in velocity in

the stratosphere. In the second paper Shaw carries the application of the equations somewhat further and making certain assumptions works out temperature and pressure from wind velocity at successive heights. There is also a statement of certain axioms or laws of motion and applications of the laws in practical meteorology. The laws stated briefly are (1) relation of motion to pressure; (2) computation of pressure and application of gaseous laws; (3) convection, which is expressed as the descent of colder air in contiguity with air relatively warmer; (4) the limit of convection, defined as that portion of the atmosphere where there exists a sensible fall of temperature with height, and (5) the law of saturation.

The irregular variations in temperature-difference as given by a pair of soundings with registering balloons; and the curious local irregularities of wind disclosed by pilot balloon ascents, hitherto explained as uncertainties of observation, are now in Dr. Shaw's opinion seen to be important as indicating complex structure of the atmosphere. If Shaw's reasoning is correct then it may be possible to get from one pilot balloon as much information for practical purposes as from three registering balloons. The distribution of isobars at 4 kilometers as computed by Teisserenc deBort is also considered and the law of convection applied. One sentence is significant and may be quoted. "All the main air-currents of the globe have pressure-distributions to guide them. They can not usefully be called convection currents." There is also a most suggestive reference to the flow of air down the Arctic and Antarctic slopes. It appears likely that whenever in a mass of air, temperature-fall is in the opposite direction to pressure-fall, great change in the horizontal distribution of pressure underneath is the result; and many of our local variations of pressure may fairly be attributed to the reactions which these cold masses of air offer to the attempt (in the end futile) of the upper air to steer them round the pole from west to east. If left to themselves they would circulate in opposition to the circulation of the upper air with which they are in perpetual conflict.

With regard to tropical revolving storms, Dr. Shaw holds that these must be considered under a different head, namely that of turbulent motion, and intimates that papers are forthcoming on this subject.

The third paper is largely made up of tables for facilitating computation in problems like those referred to above.

In the fourth paper our author deals with examples taken from typical cases of atmospheric structure selected by Mr. Cave for illustration by means of photographs of models in the "Structure of the Atmosphere in Clear Weather." Five distinct classes are considered. He introduces a new conception, that of operative pressure. How this is produced does not appear but if its existence be granted and the thermal structure of the underlying air, then the deductions drawn follow with mathematical precision. Instances of irregular distribution of temperature are explained and in the case of one marked inversion it is imagined that the construction was formed above a pool of cold air such as would be found over fog. The result of recent work is to show that as regards the weather of the present and the immediate future, the operative pressure distribution and the thermal structure of the atmosphere between it and the ground ought to be regarded as independent variables.

Shaw looks forward to the issue of maps of the upper levels wherein cloud observations and pilot balloon data will show what the actual circulation at a given level is. From these we may estimate the effect on pressure distribution in lower levels.

The papers taken together give a working plan so far as general atmospheric motion is concerned and form a distinct contribution to the solution of the problem of the life-history of cyclones and anti-cyclones.

Alexander McAdie
Blue Hill Meteorological Observatory

NAVIGATION WITHOUT LOGARITHMS[1]

Captain Guyou, of the French navy, a mathematician of note, author of valuable

[1] "Nouvelles Tables De Navigation," Emile Guyou. Berger-Levrault, Editeurs, Paris.

works dealing with the problems of navigation and member of various learned societies, has devoted part of his time since his retirement to producing tables from which a "line of position" (Sumner line) can be worked and the ship's position thereon approximately determined with the least labor and in shortest time.

The tables are preceded by a condensed explanation for the benefit of those who wish to understand their mathematical development; but the many practical and efficient navigators who bother little with theory will be interested to know what Captain Guyou does, without having to concern themselves as to how he does it.

Gird up your imagination and conceive the world and the heavenly bodies as standing still; suppose, further, that your ship is connected with a heavenly body not directly overhead—the sun, for instance—by a steel rod having a universal bearing where attached to the ship and another where attached to the sun. Start up your engine and let the wheel alone! The ship will be so controlled by the rod that she must describe an enormous circle on the face of the waters, having for its center that point on the earth's surface at which the sun is then in the zenith. Meanwhile, the rod describes an enormous cone with the sun at the apex, and when we consider that the sun's altitude, or height, is measured by the angle enclosed between the rod and the base of the cone (roughly), we can realize that an observer on board, taking the sun's height with a sextant at frequent intervals, will get the same height all the way around the circle.

The foregoing must be qualified in practise because the world does not stand still and the ship is not going to sail on a circular course; true, she is on the circumference at the moment of observation, but she may be crossing it at any angle because the position of the center of the circle and the direction in which the circumference trends depend upon the sun and not upon the ship.

If the ship be at rest, the observed altitude of the sun will change continually from hour to hour because of the apparent motion of the sun in his diurnal course. If the ship be in motion, the observed altitude of the sun will likewise change from hour to hour not only because of the sun's apparent diurnal motion, but also, although by a comparatively small amount, because of the fact that the ship is under way pursuing a certain course and making a certain rate of speed. It is evident that she may be considered to be crossing a circumference at any moment and that all sun observations *taken at that moment* from ships on different parts of that circumference will show the same altitude.

Two problems present themselves!

First: To find the circumference.

Second: To find the point at which the ship was crossing it when the observation was taken.

They have been dealt with in various ways. An able French admiral, Marcq de Saint-Hilaire, evolved an admirable solution by working out the distance from the dead-reckoning point—almost always more or less erroneous—to the circumference; his method may be outlined as follows: the navigator measures the height with a sextant, notes the time, then *calculates* the height he would have gotten at the dead-reckoning point at the moment of observation. If the two heights agree the dead reckoning may be accepted as correct, for it coincides with the circumference; this occurs but rarely; as a usual thing the dead-reckoning point falls several minutes (of distance) outside the circle or within it, two heights result, and the difference between them enables the navigator to work out the error in distance from dead reckoning to circumference. This solves the first problem!

The solution of the second is simpler because the dead reckoning is sufficiently reliable to limit to a few sea-miles that portion of the circumference at some point in which the observation must have been taken. Since the circle is very large this small portion of circumference may be accepted as a straight line. It is the navigator's "Line of Position" and the ship's crossing point thereon is closely approximated by the direction of the center

of the circle from the dead-reckoning point, which direction—since the sun is the zenith of the circle's center—is rendered by the azimuth.

But this method, though far the most desirable theoretically, involves the danger of error, the time, labor and irritation inseparable from an appalling array of logarithms—I rejoice that I am not called upon to express the sentiments with which a tired and hungry man in oil-skins regards logarithms—the calculation of height at the dead reckoning point calls for a half dozen, the azimuth for three or four more, and these operations are followed by an excursion into trigonometry to localize the result; which result, if you are an amateur, will doubtless be wrong, while, if a professional, you will not have tried it.

With Captain Guyou's tables one enters with true height and declination in a page devoted to the approximate latitude and takes out two numbers, turns to a page devoted to the approximate hour-angle and takes out two more. With these numbers he does one small sum in addition and and two in subtraction, then rules off the ship's position on the chart.

One can only admire the lofty unconcern with which Captain Guyou juggles distances, especially as he juggles them accurately. One of his circles can enclose the greater part of a hemisphere but he does not hesitate to slide it down until the dead-reckoning latitude coincides with the equator where he performs his mathematical feat with the two heights before coolly sliding the circle back again. Of course the objection at once arises that the navigator would not have gotten the same observed and calculated heights on the equator that he did get in higher latitudes, but here Captain Guyou's versatile resource comes into play, for the navigator *would* have gotten the same number of minutes of difference between the two heights (expressed in minutes of the respective latitudes). This difference, as we have seen above, yields the error in distance between dead reckoning and circumference and from it, in connection with the azimuth, the position can be worked out.

But Captain Guyou does not slide down to the equator merely in search of the above-mentioned error. He has another purpose and it is indeed ingeniously accomplished: we all know that the basis of navigation is the spherical triangle and that three parts of it—two sides and one angle, for instance—must be known before it can be solved. But tables calling for the combination of three known quantities throughout the extent of 90° of latitude and 360° of longitude would be ponderous and impractical. With only two known quantities these objections do not obtain, but two known quantities do not suffice to solve the problem. In drawing up his tables Captain Guyou has used three, of which the latitude is the third, and has employed a trigonometrical formula in which the required result is obtained by multiplying functions of the two other known quantities by the tangent of one half the complement of the third (the latitude). Since he has slid his circle down until the (dead reckoning) latitude coincides with the equator his latitude is 0°; the complement 90°; and the tangent $\frac{1}{2}$ 90° = 1, which, as a multiplier, may be disregarded, thus reducing the known quantities which must be considered to two and rendering the tables practicable.

Little knowledge of navigation is required in using them. One must understand reducing observed height to true and correcting the declination for the moment of observation. It is of course necessary to be familiar with the varieties of time used at sea. In figuring, one must know, and observe, the difference between + and —.

These moderate requirements can be mastered in a few evenings and practise may then be begun over an artificial horizon, or otherwise, for the tables include a page of directions which cover all cases and can be blindly followed to a correct result. A general conception of the principles of navigation and the problems involved will come with practise and the necessity of thinking out one's mistakes, and, in a short time, a new hand should be able to work at sight with confidence and accuracy.

Walter D. Robinson

SPECIAL ARTICLES

WHAT DOES THE MEDINA SANDSTONE OF THE NIAGARA SECTION INCLUDE?[1]

MOST geologists will agree, if stated as an abstract proposition, that a primary essential of any system of formational nomenclature is stability. In concrete examples, however, geologists display a marvelous facility in forgetting the importance of such stability or in ignoring any rules which might bring it about. This is well illustrated by the present status of the term Medina sandstone. In papers which have been read before the Geological Society of America during the last two years not less than three distinct meanings have been given to this term. The inconvenience of using any unit of measure which fluctuates in length from year to year would be no greater than that of using formation names for the geologic scale, which may differ by hundreds of feet in the thickness of beds included, according to the date or the individual author concerned. One can, of course, and in the present chaotic state of geological nomenclature generally does, in using a formation name, indicate whether he accepts Wm. Jones's or John Brown's definition of the formation. He may too have recourse to the booklets of formation names issued at intervals by some surveys, and ascertain what is the most fashionable length during the year in which he is writing for the formation in question. While these are possible and at present apparently necessary methods of indicating what one means when using a formation name, surely it would be better to adhere to a standard definition as we do for such terms of measure as foot and meter. Such a standard definition of a formation, of course, in no way precludes its subdivision as the progress of knowledge concerning it may dictate, accompanied by new names for the new sub-units. In the case of names which seldom reappear in the literature the inconvenience of changing meaning is comparatively small, but fluctuation in the meaning of such a term as Medina sandstone which occurs in most text-books on geology and in innumerable geological papers must lead to endless confusion. During the last decade a number of papers, perhaps the majority of those dealing with the Silurian of western New York, have made the term Medina include only the 100 feet of beds which are chiefly sandstones immediately preceding the Clinton; the others have included these and 1,100 feet of red shales below them as well in this formation.[2] Some inquiry into the reason for this wide diversity of usage and suggestions regarding the limitation of this term which the rules of nomenclature seem to indicate appear to be in order.[3]

These rather surprising fluctuations in the thickness of the Medina sandstone in the same section began with Grabau's[4] and Chadwick's[5] proposals to restrict the name to the upper 100 feet of Hall's Medina sandstone, the lower 1,100 feet being named the Queenston shale by Grabau. In raising the question whether there were good grounds for restricting the term to the upper beds to which the sandstone is almost wholly confined, and giving to the lower shaly portion a new name, we are confronted by two subsidiary questions. (1) Is it ever permissible or desirable to restrict or redefine the name of a formation? (2) Was the Jas. Hall usage of Medina sandstone which Grabau's proposal supplanted identical with the application given the name by Vanuxem, who first used it? Examples both of contraction and expansion of the original meaning of formation names might be cited from the papers of various geologists. Whether the practise is approved or censured, there is abundant precedent for emendation of the original meaning of geologic names.

Before considering some of the conditions under which in the writer's judgment emenda-

[1] Published with the permission of the Director of the Geological Survey of Canada.

[2] Bull. N. Y. State Mus., No. 114, p. 10.

[3] The writer wishes to acknowledge the privilege of examining before preparing this paper a manuscript by Dr. E. O. Urich which treats, among others, the question here discussed.

[4] SCIENCE, Vol. 27, April 17, 1908, p. 622.

[5] SCIENCE, Vol. 28, September 11, 1908, pp. 346–348.

tion is desirable we may revert to the second question. Vanuxem[6] introduced the name Medina sandstone into the literature in 1840, applying it to beds "called in former reports the red sandstone of Oswego." A much fuller description of the Medina sandstone was given by Vanuxem in 1842.[7] The formation is fully described in this report from exposures occurring in the Third District of New York to which Vanuxem's work was officially confined at that time. The name Medina which was given to it was taken, curiously enough, from a town about 100 miles west of the western limit of Vanuxem's field of work. Whether we consider the type section to be at Medina or in the third district where the particular section and exposures of the formation described are located, we must go to the latter region to discover just what is included in the term Medina sandstone. It is stated by Vanuxem to include sandstones lying between the Clinton above and the Oswego sandstone below. It is noteworthy that Vanuxem's definition of Medina contains no reference to shale. All of the occurrences of the Medina sandstone which he described in the third district are described as sandstone. The Medina as later defined by Jas. Hall[8] in western New York is mainly a shale formation comprising the 100 feet of sandstone just below the Clinton together with several hundred feet of red shale lying between this sandstone and the Oswego sandstone. The explanation of this apparent discrepancy between the two definitions appears to lie in the fact[9] that the upper or sandstone part of Hall's Medina extends considerably further to the east than the lower or shaly part. If Hall's lower Medina (Queenston of Grabau) does not extend as far east as the section described by Vanuxem then the original definition of Medina includes only the upper part of the beds ascribed to it by Hall, or that part to which this name is restricted by Grabau. Should this inference prove to be true, then Grabau's usage of Medina is really a return to the original meaning and not a restriction of it. In this case then it will be in order to consider whether any good reason can be offered for following the usage of Jas. Hall which makes the term include some hundreds of feet of beds which Vanuxem's definition excluded.

It is proposed here, however, to consider the question on the assumption that the application of the name Queenston to the shaly, and Medina to the sandy part of Hall's Medina was an emendation of the original usage. We may first consider in doing this some of the circumstances which may justify or necessitate emendation of formation names. Under the rules of nomenclature formulated by the United States Geological Survey for the guidance of its members it is stated that "each formation shall contain between its upper and lower limits either rocks of uniform character or rocks more or less uniformly varied in character, as, for example, a rapid alternation of shale and limestone."[10] The application of this rule to the sediments included in Hall's Medina would not permit the use of the name in a formational sense, since the upper hundred feet and the beds below are entirely diverse in character, the latter being almost entirely a red shale, and the former chiefly a sandstone terrane. This lithologic difference between the upper and lower terranes, however, would not necessarily militate against the use of Medina in the group sense. It is in this sense that the name has been used lately by the N. Y. State Geological Survey[11] and by the U. S. Geological Survey.[12] There is, however, another and very serious objection to using the term in the group sense. Until recent years the upper and lower divisions of the Medina were supposed to represent the basal part of the Silurian. No

[6] Geol. Rept. New York, 4th Ann. Rept. of the Geol. Surv. of the 3d Dist., 1840, p. 374.

[7] Geol. of N. Y., Pt. III., 3d Dist., 1842, pp. 71–74.

[8] Geol. of New York, Pt. IV., 1843, pp. 34–57.

[9] Handbook New York State Mus., No. 19, Table 2, 1912.

[10] 24th Ann. Rept. District U. S. G. S., p. 23, 1903.

[11] Handbook 19, 1912.

[12] Folio U. S. G. S., No. 190, 1913.

fossils have ever been found in the Queenston division in Western New York, but the discovery of fossils in these beds in Canada has led geologists who are familiar with the evidence to agree that they belong in the Ordovician system.[13] The fossils which have been found in the Queenston near Collingwood, Ontario,[14] place the Richmond age of the Queenston beyond question. The fauna of the upper Medina, however, as has long been known, places it in the Silurian. It is reported by Williams[15] that evidence in the shape of mud cracks at the top of the Queenston indicate a stratigraphic break between the Queenston shale and the succeeding sandstone which is the Whirlpool member[16] of the Medina. The Medina sandstone of Hall in either the group or formation sense therefore holds the anomalous position of including terranes which are not only unlike in physical characters, but which belong in different geological systems and are, moreover, separated by a disconformity. If beds can be properly kept in either the same formation or group which are so wholly unlike as the Queenston shale and the Medina sandstone of Grabau and which belong in distinct geological systems, then the terms formation and group have no value or definite meaning whatsoever in geology. It is a case where the growth of knowledge has made it impossible logically to hold to the earlier usage of Hall. In the light of present knowledge a restriction of the term so that it will not overlap systemic boundaries appears to be the only feasible method of employing it. Grabau's emendation of Hall's usage accords with the pronounced lithologic features which distinguish the upper 100 feet of the Niagara section from the beds below, and also with the later knowledge concerning the systemic relations of these beds. This application of the term Medina, which includes the Whirlpool sandstone as its basal member and the Thorold quartzite as its uppermost member, is the usage which the writer believes should and will prevail. The new name Albion which was introduced by the writer in the Niagara Folio[17] is synonymous with Medina as emended by Grabau. The latter term is therefore entirely superfluous and should be dropped from the literature.

Professor Chas. Schuchert's recent important discovery, that much of the "Clinton" of the old reports of the Canadian Geological Survey lies entirely below the base of the New York Clinton, must be taken into account in any revision of the Niagara section. Beds in this section which have shown a fauna too meager to encourage special study heretofore, and a lithologic differentiation too slight to appear to merit discrimination as separate members or minor lithologic units have taken on new significance and importance through the work of Schuchert, Parks and Williams in the region west and northwest of the Niagara section. One of these beds contains in the Ontario peninsula a rich and partly undescribed fauna which has been referred to by Schuchert[18] and Parks[19] as the Cataract fauna. The examination by the writer of a number of sections holding this fauna in connection with a review of the Niagara section has convinced him that all of the terranes associated with the Cataract fauna are represented in the Medina of the Niagara section. These have been given individual or member names in recognition of their physical and faunal contrasts by Dr. M. Y. Williams.[20]

[13] Grabau, A. W., SCIENCE, Vol. 22, 1905, p. 529; Bull. 92, N. Y. State Mus.; SCIENCE, Vol. 27, 1908, p. 622. Ulrich, E. O., *Bull. Geol. Soc. Am.*, Vol. 22, 1911, pl. 27.

[14] Foerste, Aug. F., *Ohio Naturalist*, Vol. 13, 1912, p. 47.

[15] Paper read before the Geological Society of America, January, 1914.

[16] Name proposed by A. W. Grabau, *Jour. Geol.*, Vol. 17, 1909, p. 238.

[17] This name was suggested to the writer by the U. S. Geological Survey Committee on geologic names, but since in a Federal bureau suggest and command are convertible terms the writer may reasonably disclaim any responsibility for its use as well as for the usage of Medina there employed.

[18] Paper read before Geological Society of America, January, 1913.

[19] "Excursions in Southwest Ontario," Guide Book No. 4, pp. 127, 134.

[20] Paper read before meeting of the Geological Society of America, January, 1914.

Any detailed discussion of the lithologic and faunal characteristics of these several terranes will be omitted from this paper since Dr. Williams will publish this data at an early date. These are indicated in the section given below which includes all of the formations cut by the Niagara Gorge.

Silurian.	Lockport dolomite.
	Undifferentiated dolomite.
	Gasport limestone.
	De Cew limestone.[21]
	Rochester shale.
	Clinton formation.[22]
	Irondequoit limestone.
	Walcott limestone.
	Sodus shale.
	Medina formation.
	Thorold sandstone.
	Grimsby sandstone.[21]
	Cabot Head shale.
	Manitoulin beds.
	Whirlpool sandstone.
Ordovician.	Queenston shale.

E. M. Kindle

[21] Name proposed by M. Y. Williams in paper read before the Geological Society of America, January, 1914.

[22] The term Clinton has been made to include in certain publications, among them Folio 190 U. S. G. S., the Rochester shale in addition to the beds hitherto known as Clinton. Until satisfactory evidence has appeared however, for such revision of the meaning of an old and well-established name there appears to be no reason for seriously considering either this proposed expansion of the term upwards or its expansion downwards as one geologist proposes. Frequent tinkering with the meaning of well-established names is not likely to serve any useful purpose. When revision of a name does appear to be required it should, in the writer's opinion, be accompanied by a full statement of all the evidence in the case and ample time for its discussion should be given before it is accepted. Such evidence has not appeared in this case.

NOTES ON A SHEEP THYREOID EXPERIMENT WITH FROG TADPOLES

At the time of the publication of Professor J. F. Gudernatsch's paper on thyreoid feeding experiments with the tadpole I was working with some tadpoles and having some extra ones I tried a short but similar experiment. I used the large bull-frog tadpoles which had lain over one winter. The hind limbs had begun to develop and even to joint. They were divided into two lots, the one for control and the other for experiment. The experimental

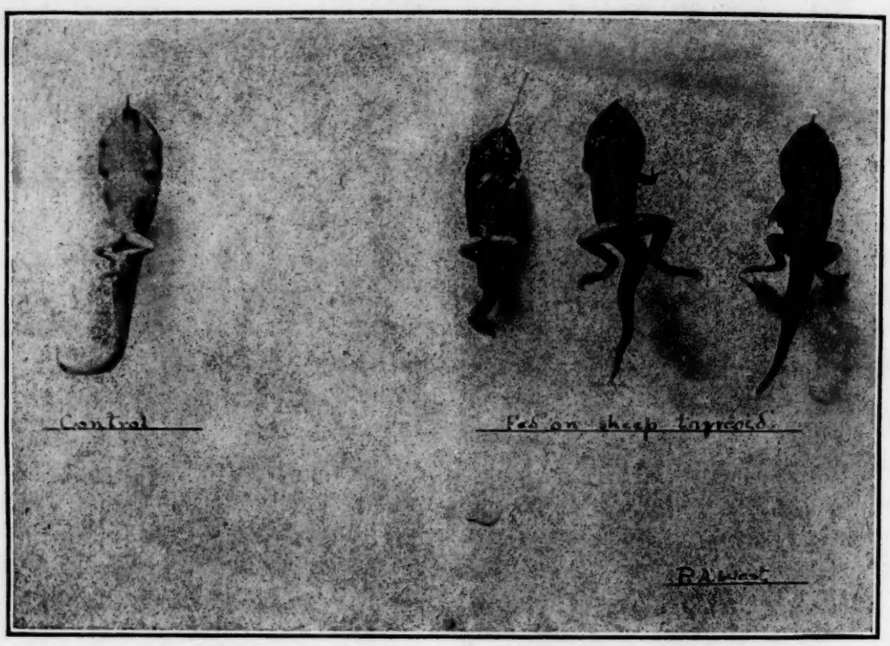

Fig. 1.

lot was placed in pond water without any food except for such minute particles as may have been suspended in the water. They were fed daily some two grain Parke Davis & Co. sheep thyreoid tablets. The tablets were eagerly eaten by the tadpoles and except for appearing rather sluggish their behavior was normal. At the end of seventeen days the hind legs had developed much more and the fore left leg had come through and begun to joint. There seemed to be a slight development of the right forelimb, but it did not come through the operculum. The control lot which had been under the same temperature and light conditions and furnished with plenty of fresh pond water and food showed a slightly increased development of the hind limbs but no signs of any fore limbs. It became necessary at this stage to stop the experiment and the specimens were preserved in formalin. Unfortunately during moving all except a half dozen of the thyreoid fed lot and a few of the control were lost, but these have been photographed and are in good condition. I cut open the opercular wall on the right side of one of the thyreoid tadpoles and found a fore leg which had begun to develop but was much shorter and less advanced than on the left side where the limb broke through of its own accord. This experiment was too incomplete to have much significance, but it was interesting to note that the right fore limb only completely developed in every case of the thyreoid fed tadpoles and in the control lot neither fore leg developed at all. This experiment may be worth while by suggesting more thorough and complete work along this line. It may possibly also be suggestive of a method for right-handed people to become ambidextrous by eating sheep thyreoid.

PAUL ASHLEY WEST

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SOCIETIES AND ACADEMIES

THE BOTANICAL SOCIETY OF WASHINGTON

THE ninety-seventh regular meeting of the Botanical Society of Washington was held in the Assembly Hall of the Cosmos Club, at 8 P.M., Tuesday, May 5, 1914. Messrs. P. V. Cardon, G. P. Van Esseltine and A. B. Clawson were unanimously elected to membership.

The scientific program was as follows:

Professor Chas. O. Appleman, "The Physiology of the Rest Period in the Potato Tuber" (with lantern). To be published as a Maryland State Experiment Station Bulletin.

Dr. H. B. Humphrey, "A Recently Discovered Loose Smut of Rye" (with lantern). To be published in *Phytopathology*.

Mr. L. H. Dewey, "The Common Names of Plant Fibers."

Confusion in the names of textile fibers of vegetable origin causes uncertainty, financial loss and injury to the trade. The name "hemp" and its forms in other languages is the oldest name used to designate a plant fiber. This name is now used in many languages as a specific term to designate the true hemp, *Cannabis sativa*, to which in all instances it was first applied, and also as a generic term to designate all long fibers. This double use is confusing. The name sisal is also being used in a similar double sense. The following suggestions are made regarding the choice of names of fibers: (1) Names in most general use are to be preferred, providing they are not misleading. (2) The same term should not be used to designate fibers from different kinds of plants. (3) One name should be used to designate the fiber from one kind of plant, irrespective of the country where the plant is cultivated, or the manner in which the fiber is prepared. (4) Geographic names are objectionable in general terms. (5) Names that may be adopted directly in all languages are desirable. (6) Single words of not more than three syllables are best.

P. L. RICKER,
Corresponding Secretary

ANTHROPOLOGICAL SOCIETY OF WASHINGTON

AT a special meeting of the Society held March 3 at the National Museum, Mr. W. E. Safford read a paper on "The Pan-Pipes of Ancient Peru." Mr. Safford became interested in the musical instruments of the Peruvians during a cruise along the west shore of South America in 1887. At Arica, near the northern boundary of Chile, he found in a prehistoric grave two sets of pan-pipes made of graduated reeds closely resembling the syrinx, or fistula, of the ancient Greeks and Romans. On terra-cotta vases were depicted men playing these instruments. Similar pipes made of bone were also found in Peru and northern Chile. Afterwards an entire orchestra composed of pan-pipes was observed. These were played in pairs, each performer having a mate with a com-

plementary instrument who played the alternating notes of the scale. That the pan-pipes of the ancient Peruvians were thus played in pairs is shown by pictures upon prehistoric vases, in which two instruments are represented as being connected by a long loose string. The pan-pipes observed were in most cases composed of 16 reeds, in two rows, one row superimposed upon the other, the row played upon by the performer having the reeds closed at the bottom, the outer row having reeds with an opening at the bottom. The smallest pair produced shrill notes like those of a piccolo; the largest pair, four times as long, produced deep tones much like those of a barrel organ.

At a special meeting of the society held March 4, at the National Museum, Dr. A. B. Lewis gave an address on his "Travels in the South Seas and New Guinea," illustrated with excellent lantern slides. The four years 1909–13 were spent in the interest of the Field Museum of Natural History of Chicago, studying the natives and collecting ethnological material, chiefly in Melanesia. Many of the islands are only partially explored. Fiji is the most civilized. The natives of Fiji are all professing Christians, and read and write their own language. Except the ordinary things of everyday life, there is little of the old left. The native Fijian population is about 90,000, the European 3,500, while there are 40,000 to 50,000 Indian coolies on the sugar plantations. New Caledonia was, for years, a French penal colony, and the natives are reduced to about 30,000 located on reservations, much as our American Indians. Some of the large islands of the New Hebrides are still wild and unsafe. To the ethnologist, Malekula is the most interesting. Over 20 languages are spoken on this one island, to say nothing of dialects. On the Solomon Islands there are probably not over 300 Europeans. New Guinea is the most interesting island of all. Except Greenland, it is the largest in the world, and the least known. New Guinea has never been crossed except near the ends. More time was spent on New Guinea than anywhere else. A considerable portion of the coast was visited and short trips made toward the interior. There are but few Europeans in New Guinea, the greater number, about 1,000, being in the British portion. A considerable number of these are gold-diggers. In German New Guinea there are about 200 Europeans, and in the Dutch portion not over 50. The old condition of warfare among the natives has been stopped as far as the government can extend its influence.

At the 473d regular meeting of the society, held March 17 in the National Museum, Dr. J. Walter Fewkes delivered an address, illustrated with lantern slides, on his "Egyptian Experiences." He considered especially the significance of certain parallelisms in cultural objects of the Stone Age of Egypt and the Gila Valley, Arizona. These resemblances he ascribed in part to the influence of irrigation. Through the cultural isolation of the Nile Valley in Neolithic times it was protected from outside marauders. Social advancement at the dawn of history was due to the influx of foreign ideas from the east and to the cooperative union of clusters of villages or nomes in order to more effectually irrigate the valley. This cooperation of the rulers of Neolithic Egypt led to the rise of a Great House or Pharaoh. To this cooperation in constructing irrigation ditches may be traced a system of enforced labor in which the Pharaoh not only acquired all cultivated land and the water which alone made agriculture possible, but also controlled all labor of the inhabitants. To these rights acquired from the rulers of the nomes in very early times, may be traced the powers exercised in constructing the magnificent monuments that are the world's wonders.

In Neolithic Egypt, there was a succession of villages strung along the river, each independent of the other, like a cluster of pueblos in Arizona. The remains of architectural constructions at this early epoch still remain and are sometimes, as at El Kab, well preserved. They are rectangular, massive, walled forts with an encircling wall of clay not unlike the compounds at Casa Grande in Arizona. Within these enclosures, in Egypt and Arizona alike, were mud or clay built temples, public buildings and houses of priests, while around them were clusters of the mean hovels in which lived the people like the present Egyptians. The dead were buried in neighboring mounds, placed with knees drawn to the chin and surrounded by mortuary offerings. These graves were rude excavations with floor of straw and roof of mud and boughs. Many resemblances between archeological objects from the Stone Age in Egypt and in the Gila Valley were pointed out. Among these are weapons, stone implements, pottery and its symbolic decorations, flat basket trays, bone and other specimens. Certain common conditions of environment and the necessity for artificial irrigation had led the Stone-Age people of different races, without connections, to develop a parallel culture.

Daniel Folkmar,
Secretary